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[OFFICIAL NOTICE.]

Where to Find the Western Gas Association's Exhibit, and the Custodian Thereof, at the World's Fair.

To the Fraternity: The exhibit of the Western Gas Association, at the World's Fair, St. Louis, is located in Section 33A, Liberal Arts Building, where Mr. Fred. R. Persons, who is in charge of the same, will always be on hand to receive visitors and to explain anything that requires explaining.

[OFFICIAL NOTICE.]

Thirty-Second Annual Meeting, American Gas Light Association.

AMERICAN GAS LIGHT ASSOCIATION,
OFFICE OF THE SECRETARY,
NEW YORK CITY, Sept. 14, 1904.

General Announcement.—There will be an annual meeting of the American Gas Light Association held at Washington, D. C., October 19th to 21st, 1904. The meeting will be called to order by the President, Rollin Norris, of Philadelphia, Pa., at 10 A.M., on Wednesday, Oct. 19.

The meeting hall will be on the tenth floor of the New Willard Hotel. The headquarters will be at the New Willard Hotel, 14th and F streets, Washington, D. C.

The most satisfactory quarters are always obtained by writing in advance to the hotel people, and in doing so a reply should be requested, for which a self-addressed stamped envelope should be inclosed, as misunderstandings may thereby be averted.

The New Willard Hotel is conducted solely on the European plan, and the rates for rooms will be as follows: Rooms without bath, $2.50 per day and upwards; rooms with bath, $3.50 per day and upwards. Double rooms without bath, $4 per day and upwards; double rooms with bath, $5 per day and upwards.

As the meeting room is in the hotel, it is hoped that all will make their headquarters at this hotel. There are, however, other hotels in the vicinity.

The roll call will be made by means of the door card system. Each member upon entering the hall for the first time will, at the door, receive a special card upon which he will find his name, address, etc., as it appears on the Secretary's books, and such card should be corrected and given to the doorkeeper. Members in attendance should attend to this very carefully, as these cards are used immediately after the meeting for correcting the annual membership list. Visitors will please hand to the doorkeeper their personal cards. A blank form of application for membership accompanies this circular. More can be obtained of the Secretary.

Remember, all applications must be in the hands of the Secretary by October 10th at the very latest, otherwise they will not be acted upon at this meeting.

The list of papers to be read at the meeting is as follows:

"Generation of Steam by Waste Heat from Water Gas Sets," by Donald McDonald, Louisville, Ky.

"Distributing Power Throughout a Gas Works by Means of Electricity Generated at a Central Point," by W. A. Baehr, St. Louis, Mo.

"Oxide Purification," by E. H. Earnshaw, Philadelphia, Pa.

"Methods of Charging for Gas," by F. W. Frueauff, Denver, Colo.

"Consumers' Meters," by B. H. Spangenberg, Philadelphia, Pa.

LIBRARY OF CONGRESS. SEP 26 1904 SMITHSONIAN DEPOSIT.

There will also be discussions on subjects connected with coal gas manufacture.

All members attending the meeting are particularly requested to wear their membership badges in plain sight, thereby greatly aiding the officers and the local committee in their work, by affording a ready means of recognition.

In order that the year book containing the report of this meeting may be published and issued to the members immediately after the meeting, notice is hereby given that if any of the speakers at this meeting desire to correct their remarks before they are printed, they will be given an opportunity before leaving Washington, but not after. The stenographer will have typewritten copy of the principal discussions prepared at the headquarters between the sessions of the meeting, and all those who desire to correct their remarks must notify the Secretary at the close of the session at which such remarks are made, as all the reports will be turned in to the printer immediately after the adjournment of the meeting.

Special.—As Washington is a very interesting city, it has been decided to have no entertainment on Wednesday night—leaving the members free at that time. There will, however, be a banquet on Thursday evening, and a steamboat excursion to Mount Vernon on Friday with luncheon.

For the ladies there will be on Thursday a trip around Washington in automobiles, and the Mount Vernon trip on Friday.

There will probably be a theater party for the ladies on Thursday evening, as the banquet will be for the men exclusively.

The price of tickets, including all the entertainments, will be $5.

A. E. FORSTALL, Secretary.

[Special Editorial Correspondence.—By Telegraph.]

Twelfth Annual Meeting, Michigan Gas Association.

OTSEGO HOTEL, JACKSON, MICH., September 22, 1904.

Dear JOURNAL: Splendid weather, an attendance of 85, hotel accomodations and meeting hall in every way excellent, seem to have convinced the Michigan Gas Association that no mistake was made in changing the date of the annual meeting from March to September. The first session was taken up by routine business, President Wolff's address, the paper by Mr. V. F. Dewey, of Detroit, Mich., on "Temperature as Applied to the Production and Purification of Coal Gas," and the paper on "Commercial Lighting," by Mr. R. Shacklette, of Adrian, Mich. The President's address was really a strong, well put together message, which touched upon points of vital interest, and did so in a trenchant and easily understandable way. Let me say here, too, that Mr. Wolff, as a director of assemblages, will come up to measuring even with the best of them.

Mr. Dewey's paper showed that he had studied his theme thoroughly, and the experimental work revealed by its paragraphs was little short of amazing. Undoubtedly it will be a reference paper for a long time to come. Mr. Shacklette's mention was of the true business sort, and his "Commercial Lighting" ways-and-means brought out a good discussion. The afternoon session was mainly devoted to a discussion of the contents of the Question Box, which under the careful Editorship of Mr. Earnest F. Lloyd was well filled with matter the nature of which caused much debate. On the evening of the first day (Wednesday) the Association and its friends were the guests of the Jackson Gas Company who opened the round of pleasure with a theater party and closed it with a gem of a supper served in the handsome house of the Jackson City Club. The Scholarship paper—by Messrs. E. H. White and Samuel Ball—on "The Formation of Naphthaline in Coal Gas"—took up all our time during the morning session of to-day (Thursday), wherefore it was necessary to hold a session in the afternoon for the consideration of the interesting paper by Mr. George C. Turner, of Coldwater, Mich., on "Retort House Practice in Small Works," for the election of officers, and other routine business. The officers elected were:

President—Ernest F. Lloyd, Detroit, Mich.
Vice-President—W. H. Barthold, Grand Rapids, Mich.
Secretary and Treasurer—H. W. Douglas, Ann Arbor, Mich.

Thirteen active and 12 associate members were elected, which brings the total up to the 200 mark. The action taken by the Association in respect of the Doherty proposition for concerted work amongst or by the various Associations was the result of much consideration. Meanwhile let me say the Michigan is proud of the work initiated by it in the educational line, which trial has brought out good results. The meeting was an excellent one.—D.

BRIEFLY TOLD.

DEATH OF MR. OSCAR B. WEBER.—A year ago he who prophesied that Oscar B. Weber's life was for only a twelvemonth would have less than the ordinary credit given to any sort of prophet, but the stern fact remains that the robust, jocund, smiling, jollying Oscar is dead. He died at the Stratford, this city, the afternoon of the 16th inst., from the outcome of an operation for liver trouble, by which ailment it seems he had long been afflicted, the ravages of which he fought with vigor and not complainingly. A particularly sad feature of his ending lies in the fact that his father, mother and favorite sister were abroad on a trip at the time of his ending. He was born in New York City, August 6, 1858, and was the son of Adam and Catherine Weber—it is hardly necessary to remind any of our readers that Adam Weber was one of the pioneers who blazed the way for the scientific manufacture of fireclays in different shapes and forms, and if we mistake not he was the second to manufacture fireclay retorts in America, the first in that line being Mr. J. K. Brick, of Brooklyn, N. Y. That, however, is really extraneous to the story, however interesting it may be. Deceased received his education in the College of the City of New York, graduating therefrom in the Class of 1880. He immediately engaged in business, under the tutelage and guidance of his father, whose extensive fireclay works on 15th street, east, this city, were known amongst gas men here and abroad. In 1890 the senior Weber retired from active business, the latter being transferred to an incorporated company, known as the firm of Adam Weber's Sons. Of this concern Oscar B. Weber was chosen President, and remained as such until his death. In 1891 the manufacturing plant was removed to Weber, N. J., at which place a model establishment, of a huge order, was constructed by the firm. Deceased was a very prominent figure at the various gas association meetings. He was an active member of the American Gas Light Association and of the Pacific Coast Gas Association, and an associate member in the Western Gas Association, and his loyalty to the Association principle could never be rightfully questioned. He was noted for his knowledge of music, and in his death the students of that art have lost a supporter and its active interpreters a hearty aid. He was a member of the Liederkranz and Arion Societies of New York, and wherever the music lovers assemble there was the name of Oscar B. Weber well known and respected. He was a prominent member of the Lotus Club, of New York, and his connections with other semi-public and private organizations were many. In 1886 he was united in marriage to Laura A. Weber, who survives him, as do his father, mother, two brothers and two sisters. The funeral services were held at his home, 1382 Lexington avenue, New York, the morning of the 19th inst., the Episcopal ritual being delivered by Doctor James H. Darlington, of Christ Church, Brooklyn, and the mourning assemblage numbered many men prominent in the gas industry. The musical rendering by the Liederkranz Society, under the direction of Mr. Arthur Classen, was solemn and beautiful. Interment was made in the Weber mausoleum, Woodlawn Cemetery.

SOME RANDOM NOTES FROM THE WORLD'S FAIR.—No. III.—World's Fair, St. Louis, Mo., Sept. 19th: Dear JOURNAL: The gas men and the friends of gas men who registered here the past week were: Mr. and Mrs. Jno B. Strain, Detroit; Chas. Miller, Pensacola, Fla.; Al. Savy and H. Hamelle, Paris, France; F. B. Archer, Bellevue, O.; E. C. Hanrahan, Chicago; W. Drench, Paris, France; M. Beck, St. Louis, Mo.; R. Hitchcock, New York; L. P. Lyman, Everett, Mass.; S. L. Steele, Colton, Cal.; Geo. Beadenkopf, Baltimore, Md.; A. D. Hopper, Spokane, Wash.; J. S. Newbold, Syracuse, N.Y.; M. Faturis, Beyrout, Europe; L. E. Walker, Lansing, Mich.; R. W. Polk, Rutland, Vt.; F. L. Marshall, Centralia, Ills.; J. D. von Maur, St. Louis; J. M. King, St. Louis; C. R. Sprout, Waynesburg, Pa.; L. P. Lally, St. Louis; E. M. Pierce, St. Louis; Geo. Benjamin, St. Louis; F. A. Cotton, New Haven, Conn.; Mr. and Mrs. S. C. Schaffner, Mobile, Ala.; Mr. and Mrs. E. S. Dickey, Baltimore; J. C. Elston and W. Lawlor, East St. Louis, Ills.; R. I. Spear, Little Rock, Ark.; P. T. Norton, Nashua, N. H.; S. B. Lane, Woodward, O. T.; D. C. Brainard, Carthage, Mo.; H. M. Blake, St. Louis; S. Ichei, Yokohama, Japan; F. A. and W. F. Miller, Bradford, Pa.; and Forrest E. Barker, of the Massachusetts Commision. The week was a busy one here. I understand the 3,000-horse power gas engine is being put in place in Machinery Hall and will soon be in operation. An invitation has been sent out, signed by several firms, asking gas men to meet here while *en route* to the Washington meeting of the American Gas Light Association. The idea seems a good one, and several favorable responses have been received.—FRED. R. PERSONS.

[Continued from Page 452.]

TWELFTH ANNUAL MEETING, PACIFIC COAST GAS ASSOCIATION.

HELD IN MECHANICS' INSTITUTE, SAN FRANCISCO, CAL., JULY 19 AND 20, 1904.

SECOND DAY—AFTERNOON SESSION.

Mr. L. P. Lowe read the following paper on

SOME PRACTICAL OBSERVATIONS ON THE FLOW OF GASES IN PIPES.

Since the inception of the gas business until almost the present time very little more than passing thought and attention have been given to the subject of the flow of gases in pipes, superintendents and engineers of gas companies making and delivering artificial gas having been more or less satisfied with existing conditions, and when troubled with an insufficient gas supply to consumers have temporarily removed the difficulty by laying additional or larger sized gas mains, while still retaining the initial low gas delivery pressure given by the gasholder.

For this condition two cardinal reasons have been principally responsible, one of which has been the very strong prejudice existing against the use of anything but cast iron pipes for street mains, the other being the general belief that if manufactured gases were subjected to even very slight pressure it would cause a loss of illuminating power, this loss supposedly so rapidly increasing as pressure increased that if but, say, a few pounds were applied, a total loss of illuminating value would be the inevitable result, and, as "candle power" then meant everything, a mere suggestion of increase of pressure was looked upon as being heretical and even traitorous.

True it is that the natural gas man and the pipe manufacturer have laboriously and unfailingly taught the value and success of wrought pipes and high pressure, but it was argued that natural gas was not manufactured gas, and prejudice—that black bigot, that hideous demon, that irrational zealot, that witch-burnihg retarder of the world's development—could easily be depended on to do the rest.

It is not, however, to the discredit of our brethren of the gas fraternity that this Rip van Winkle, slow awakening condition existed, ior it must be remembered that we are, to a man, more or less "from Missouri, and must be shown;" bearing in mind the fact that with the locomotive came the objection that the poisonous fumes belching forth from the stack would destroy the birds and fowl of the air; the fact that the first fire engine of Philadelphia, throwing sparks from its funnel, was deemed more dangerous than beneficial and was pushed by the mob into the Delaware river; the fact that the world's future highway vehicle, the automobile, is even now being stoned in the streets of New York; the fact that the "carbonic oxide" cry has not yet ceased, and countless thousands of other such facts, due wholly to hateful prejudice.

True it is that our very instincts of self-preservation compel prejudice. We draw it from our mothers' breasts and the very marrow of our bones fairly reeks with it; and for some unaccountable reason it would seem to be one of nature's laws that progress and enlightenment must be by a slow, very slow process of evolution. But think it over, study the question, try and look ahead, do not place a one cent piece so close to the eye that it hides the dollar just beyond, give the thought of the "other fellow" some of your thought, and be as little prejudiced as possible.

It goes almost without saying that a gas to withstand compression and delivery under high pressures, in a commercially successful manner, must be as nearly as possible a "fixed gas," and this requirement at once raises the question as to what is a "fixed" gas. As a matter of fact the term "fixed," as applied to gases, is tautological, as a true gas cannot be otherwise than fixed and permanent until it is dissociated or changed chemically, as by burning.

A gas may be physically or mechanically changed, and it is a very common and everyday practice to do so in a commercial way. For instance, by application of high pressure ammonia gas is liquefied and largely used in refrigerating processes, carbonic acid gas is also liquefied and very extensively used, and the now well known liquid air is another instance; but notwithstanding the changed appearance of the gases so compressed and liquefied, the condition is merely a physical and temporary one and lasts only as long as the enforced conditions are maintained.

Physically all gases have what is known as their "critical" point; that is to say, under changed conditions of temperature and pressure they assume liquid form, this critical point varying greatly however in the different gases. Upon release from enforced pressure and return to normal physical conditions the composition of the gases will be found to be the same as before compression, thus proving them to be true and fixed, or permanent so far as physical or mechanical conditions are concerned.

With the case of vapors the conditions are entirely changed as vapors are constantly changing their physical conditions. For instance, steam or water vapor when released into the atmosphere rapidly returns to liquid form, and every gas man knows or should know that generally speaking the water taken from drip pots was once suspended in vaporous form in the gas. It was never "fixed" or it could not have changed its form physically, for broadly speaking none other than physical conditions can exist in gas pipes.

What has been said of condensation of water vapors in manufactured gas applies as well to the tarry and oily substances sometimes found in gas pipes. These substances were never fixed gases, being nothing more or less than hydrocarbon vapors, and which ultimately condensed.

A vapor may be fixed into a gas, but the term "fixed" as applied to gases is a troublesome misnomer which has unfortunately attached itself to the nomenclature of gas literature and probably to stay. Possibly no better term can be found to distinguish high class manufactured gases, the constituents of which are almost wholly permanent ones, from the vaporous concoctions of fake gas promoters, and for public use it may be a good word, but as gas engineers, superintendents and managers let us not misunderstand the term.

There are 7 generally recognized constituents of manufactured illuminating gases, as follows, their common names being used: Hydrogen (H_2); oxygen (O_2); nitrogen (N_2); marsh gas (CH_4); carbonic acid (CO_2); carbonic oxide (CO); heavy hydrocarbons (C_nH_{2n}.)

The first 6 of the gases in this list are permanent ones and usually comprise from 90 to 95 per cent. of the entire volume. The 7th constituent, the heavy hydrocarbons (sometimes called illuminants), is a complex mixture of a number of olefine or oily gases, all of which are also permanent, and in addition there is usually a small percentage of oily vapor which escapes entire fixing in the process of gas manufacture and subsequent removal in the washing, scrubbing and condensing operations.

As the cleansing process of manufactured gas usually compels its intimate contact with water, and as, upon completion, it is stored in gasholders over water, it is not surprising that it should and does hold as much water vapor as possible in mechanical suspension, the amount depending upon the pressure to which the gas is subjected (barometric or otherwise) and its temperature.

It will thus be observed that good manufactured gases contain two constituents which can be and are removed more or less completely by compression, one of which is hydrocarbon vapor, the other water vapor. Both are in very small percentage quantities and in a well made and permanent gas the loss in illuminating value can only be very small, but if perchance the gas be of a kind which owes its value largely to unfixed vapors, it is then not a good one to compress, as all vapors, whether hydrocarbon or water, will be condensed to liquid form and thrown down just as water is when squeezed from a fully saturated sponge, and the greater the amount of "squeeze" or compression the more completely will the vapors be condensed. Compressing gas is in fact a good condensing and cleaning process.

The flow of gases in pipes is governed by 5 factors: Specific gravity, initial pressure, terminal pressure, length of pipe and frictional resistance, all being more or less controlled by local conditions.

For many years gas men depended on the well-known formula of Dr. Pole in calculating the quantity flow of gases in pipes, which formula is as follows:

$$Q = 1{,}350 \times D^5 \sqrt{\frac{D \times P}{S \times L}}$$

Where D = internal diameter of pipe in inches;
" P = pressure of gas in inches of water;
" S = specific gravity of gas (air = 1);
" L = length of pipe in yards;
" Q = quantity of gas in cubic feet per hour.

So far as it goes this formula is very useful, but its limitations are soon reached as it fails to take into consideration the fact that a volume of gas occupies a space in direct proportion to the number of atmospheres pressure exerted upon same. An "atmosphere" is 14.7 pounds or say 15 pounds, as it is so considered in practical calculations where extreme accuracy is not required. If a cubic foot of gas at atmospheric pressure is subjected to an additional "atmosphere," say 15 pounds, shown on an ordinary pressure gauge (for instance, in a cylinder fitted with a piston), its volume will be reduced to ½ cubic foot. If now an

additional "atmosphere" of pressure be exerted (say 30 pounds gauge pressure) the original 1 cubic foot will be reduced to ½ cubic foot, and so on until the point of liquefaction is reached, which however will never be the case in the practical delivery of illuminating and heating gases for commercial uses.

It will be noted from the above that by compressing gas a very much greater quantity of what is known as "free gas" (that is, measured at atmospheric pressure) can be placed in a vessel of a given size than the actual cubical contents of the vessel. For instance, a tank which will contain 1,000 cubic feet of gas at atmospheric pressure will, at a gauge pressure of say 15 pounds, as explained above, contain 2,000 cubic feet, and at a gauge pressure of 30 pounds 3,000 cubic feet, and so on, and as this factor is not taken into consideration in the Pole formula it is useless in connection with what is now known and recognized as high pressure gas delivery, but very useful and comparatively simple if only ordinary gasholder pressures are to be considered.

Several years ago, when the writer first set about seeking a reliable formula governing the flow of gases in pipes under very heavy pressures and over distances running into the hundreds of miles, he found an almost entire lack of general, and very little individual, information on the subject.

Eastern natural gas men were appealed to, and while some were obliging and courteous to the extent of calculating and giving answers to specific problems, none would furnish his formula, which he seemed to treasure and hide within his bosom as though of untold value.

Manufactured and natural gases are, however, nothing more or less than elastic fluids, such as air and steam, and fundamental information was sought in these fields, with the result that, step by step, a formula was developed which was thought to be reliable, and which is as follows:

$$Q = C \times \frac{P + 14.7}{14.7} \sqrt{\frac{D^5 \times (P_1 - P_2)}{.0761 \times 5 \times \frac{P_1 + 14.7}{14.7} \times L}}$$

Where P_1 = initial gauge pressure;
" P_2 = terminal gauge pressure;
" S = specific gravity of gas;
" D = internal diameter of pipe in inches;
" L = length of pipe in feet;
" C = a "variable constant. (For value of *C* see note below);
" .0761 = weight of 1 cubic foot of air at atmospheric pressure;
" Q = cubic feet of gas per minute at atmospheric pressure.

Note.—Values of constant *C*:

Diameter of pipe in inches..	¼	2	3	4	5	6	7	8
Constant.....	36.8	52.7	56.1	57.8	58.4	59.5	60.1	60.7
Diameter of pipe in inches..	9	10	14	16	18	20	22	24
Constant.....	61.2	62.1	62.3	62.6	62.7	62.9	63.2	63.2

It will be noted that in this formula the constant (C) changes (if it may be so explained) with pipes of different sizes, owing to the very greatly increased frictional resistances in pipes of small size. If only a single constant is used a formula is not reliable until pipes become of such large size as to permit of the use of such a single constant.

Ii must be remembered, however, notwithstanding the fact the formulæ are empiric—that is, developed from experience—they become largely theoretical owing to local conditions, and must be accepted as such. This particular formula may be said to have been proven owing to the following incident:

The writer, in seeking practical information governing the transmission of gas through long, high pressure lines, discussed the subject at length with an Eastern engineer who has deduced a natural gas flow formula from about 20,000 observations made at dffferent line points during an entire winter, recording gauges having been probably largely used. A gas flow computer had been worked out from the information secured, and replies could, therefore, be and were immediately given to numerous hypothetical queries, though an inspection of the computer, which was one of the slide-rule type, was not permitted.

Subsequent comparisons of this practical information were made with calculations from the above formula, and found to so nearly tally as to be almost identical, and this formula is, therefore, looked upon by the writer as being reliable so far as knowledge, born of the present state of the art, permits.

The formula is based on pipe lines constructed of wrought pipes joined with ordinary screw fittings and contemplates straight runs without sharp, right angle bends which destroy the kinetic energy of the flowing gas and thus greatly reduce the efficiency of operation.

Much has been said and written, but very little has been understood and appreciated, on the importance of preserving to the utmost practical extent the kinetic energy of flowing gas, and as the term is one but seldom used it may be well to explain that by kinetic energy is meant the power stored in a moving object which keeps it in motion after the source of power has been removed. By way of illustration, conceive a railway train rushing along a straight, level stretch of track, the train being driven to its power limit. If the source of power, say the steam pressure, is now suddenly removed by closing the throttle, the train will continue to run or "coast" for a long distance, due to its kinetic energy, gradually reducing in speed until the energy is exhausted and the train stops.

Consider now the same illustration, save that as the throttle is closed the train "coasts" along a level track having numerous curves of various degrees. Each curve absorbs a certain amount of the kinetic energy of the train, the short and sharp ones using more than the long and easy ones, owing to greater frictional resistance. If the train is driven rapidly over these same curves each one becomes a thief of power, the shorter ones stealing more than those of long sweep. These are homely illustrations and scarcely scientific as descriptive of kinetic energy, but they will serve the purposes of this practical paper.

So it is with the flow of gas through pipes, and if the flow is derived at the expense of mechanical power it means increased cost of operation when the ordinary short bend fittings are used, and a saving when long sweep fittings are adopted, and the longer the sweep the greater the saving.

As an illustration, let us assume a 4-inch pipe 1 mile in length through which it is proposed to deliver gas of a specific gravity of .450, the initial pressure used being 10 pounds and the terminal or final pressure being 0, or that of the atmosphere. If this pipe is laid on a level and in a straightaway length without bending, the amount of gas delivered per minute (as determined by the formula) will be 564 cubic feet. Assume now the same conditions, save that at a ½ mile distance the pipe turns at a sharp right angle and runs an additional ½ mile; to deliver the 564 cubic feet as with the straightaway example the pressure required will be 10.9, an increase of 9 per cent. Assume again that in the 1 mile length 3 sharp bends are used; under these circumstances a pressure of 11.3 pounds will be required to deliver the 564 cubic feet per minute, or an increase of 13 per cent. over the straightaway example. The increase of pressures required is due to the loss of kinetic energy, which will be very much lessened if the long sweep fittings are used.

As pressures increase the percentage loss is even greater; for instance, if the same example is taken as above, save that instead of using an initial pressure of 10 pounds, a pressure of 50 pounds is used with a terminal pressure of 0, the delivery of gas through a straightaway section will be 2,050 cubic feet per minute, while if in the same length of pipe there are 3 sharp bends, the amount of pressure required to accomplish the same gas flow will be 60.3 pounds, an increase of 20.6 per cent.

The problem of high pressure gas delivery is just now attracting much attention from the gas engineering fraternity and several more or less reliable high pressure formulæ governing the flow of gases in pipes have been published. As in the case of the formula given above, they almost all involve a calculation of the power, and as this calculation is somewhat of a tedious one, Mr. F. H. Oliphant, a natural gas engineer and expert, has given a formula in Volume 6, pages 548 to 594, of the Ohio Geological Survey Report, from which formula has been eliminated the fifth power calculation, and which is as follows:

$$Q = 42a \sqrt{\frac{p_1^2 - p_2^2}{l}}$$

where Q = cubic feet per hour as above, p_1 and p_2 are gauge pressures plus 15 pounds at intake and discharge ends of line and l is the length in miles. The factor a is found for various sizes of pipe in the following table:

d; Inside.	a.	d; Inside.	a.	d. Inside.	d. Outside.	a.
0.25	0.0317	5	60	14.25	15	863
0.50	0.1810	5½	81	15.25	16	1,025
0.75	0.5012	6	96	17.25	18	1,410
1	1.00	8	198	19.25	20	1,860
1.5	2.93	..	....	Riveted or cast iron pipe.		
2	5.92	10	350	20	..	2,055
2.5	10.37	12	556	24	..	3,285
3	16.50	16	1,160	30	..	5,830
4	34.10	18	1,570	36	..	9,330

This last formula is for a pipe of 1-inch diameter, and as the delivery

increases more rapidly than the square root of the fifth power of the diameter the cube of the diameter divided by 30 is added to this radical. Where the gravity of the gas varies, the quantity found is multiplied by the square root of 0.6 divided by the square root of the gravity as determined.

Problems worked by this formula, as against the more elaborate one given above, show that when gas is delivered at comparatively low pressures, say up to 10 pounds, the results are very nearly alike, but as pressures increase, and especially when they become rather high, say in the neighborhood of 100 pounds, the results show a considerable difference, the formula given by the writer showing a greater amount of gas delivery than the one given by Mr. Oliphant.

For many years the flow of gas in pipes was very much of a mystery to the writer, who so to speak longed to get inside and see what was going on, and it was only a little more than a year ago that his curiosity was satisfied, and then in such a simple manner that it is surprising the illustration is not generally known. Before recognizing it, however, it was necessary to learn and accept the fact that broadly speaking the general laws which govern the flow of gases in pipes are the same as those which govern the flow of water.

Standing one day in a gas works wherein there is rather an intricate system of water troughs extending from various parts of the gas making apparatus, and finally connecting in a common outlet, it was noticed that the arrangement of troughs bore a certain resemblance to an ordinary gas main system and, therefore, the action of the various streams of water was carefully noted, with the result that it was evident anyone can easily gratify a desire to study the phenomenon of the flow of gas through pipes by merely building a system of small open water troughs showing about the same connection fittings as would be used in a gas main system.

The "banking up" and retarding of the flow is shown at the sharp bends and also the ease of passage over long sweeps. The lack of pressure on a "dead end" can also be clearly shown, and if in the sides and bottom of troughs imperfections are made representing joints of pipe, the eddies set up by reason thereof will clearly show the great value of having as smooth an interior surface as possible. If the experimenter cares to take the trouble he can also drop a few iron borings on trough bottom and note what happens to gas flow by reason of the borings dropping on pipe bottoms at points of service connections, and with less trouble than it takes to make similar connections to a gas main he can see what happens when the end of a service pipe projects into the main. If he likes he can also introduce particles of sawdust into the flowing water which will assist him in more easily observing the swirls and eddies and also permit of an interesting study of the frictional loss at sides of trough by noting the slow moving particles at sides as compared with the rapidly moving ones at center of stream. It is all very interesting and well worth the effort.

It seems almost unnecessary to call attention to the fact that the manufacturers' stated sizes of pipes are only nominal and not actual, and that the pipes known as "casing" (as well as boiler tube weights), as usually carried in stock, are designated by their outside and not inside dimensions, but it is only the inside dimensions which count in gas flow.

The practical lessons to be learned in pipe laying so as to afford the best conditions for the flow of gas are: Procure a pipe having smooth interior surface; protect it as well as possible against corrosion; lay it in a careful manner and in such a way as to give as smooth and flush inside joints as possible; use long sweep fittings, even if they must be specially made, and in making service or other connections, see that the main pipe is not obstructed thereby.

Discussion.

Mr. Doherty—A thing that interests me very much is that Mr. Lowe had a "variable constant," a constant that was not a constant. I suggest he selects another name for it. (Laughter.)

Mr. Lowe—I will accept your suggestion if you give one.

Mr. Jones—Why not call it a variable, leaving out the word "constant?"

Mr. Lowe—It is a constant for a given size of pipe; but this formula contemplates the flow of gas through pipes from ¼ inch to 24 inches. I did not see any way of expressing it better. It is a constant so far as one size of pipe is concerned. For every size of pipe until you get into the relatively large sizes you must vary your constant; use a separate constant for each size. In connection with digging up this information I must say it is not very much to the credit of the Eastern engineers that they can give us so little information. Mr. Martin and I were very much interested in the study of the transmission of gas through long lines under high pressure, and travelled together in the East seeking information. Finally we arrived at a town in Connecticut where we met a gentleman who had had a great deal of experience in the transmission of natural gas; but while he would answer our questions offhand by a little sliding rule, he would not let us see it. However, since then I have built one of my own (showing it) and we now have a slide rule that works this formula immediately. It has been my intention to publish it, but I cannot devote much time to these matters, and do very little more than go into the general subject and then pass it on to one of my engineers. The development of the slide rule has been due to my engineer, Mr. Horne, rather than to me.

Mr. Doherty—I am not able to state whether that formula would work or not. What I have been anxious to do is to develop a rational formula for computing flow for any pressure. I have also felt that any liquid ought to follow the same general law and that the one or two constants we should add would be density and friction, which would bring your gas formula and liquid formula together and get rid of this variable constant of Mr. Lowe's. I have been trying to find out and to put the value of the wetted sides of my barometer (which would correspond in a gas pipe to the walls of the pipe) below as a detracting factor. Now I would like to ask what the figures .0761 are?

Mr. Lowe—That is the cubic feet of air. The Pole formula does not take into consideration the difference of pressure. It takes into consideration initial pressure only. It would be better if you would consider "P" as difference of pressure rather than initial pressure.

Mr. Doherty—I have seen it in some old book that "P" is to be taken as difference of pressure.

Mr. Lowe—Even then it does not take into consideration the question of increased volume of free gases due to compression. As a matter of fact this lower formula is a modification and development of the D'Arcy formula. If you will seek in other fields, as I was compelled to, for information on the flow of gas, you will find that the most reliable information is that concerning the flow of steam. The same laws that govern the flow of steam (with allowances for the difference of specific gravity of gas and steam, as over the ordinary gas) you will find very useful in investigating flow of other gases.

Mr. Doherty—While not called upon to do so, I would like to apologize for those engineers that Mr. Lowe found so reticent. I think I can explain the reason. They did not have the formulas and they did not know. When they have something up their sleeves it is generally a little table that is published by the compressor people. It is to cover their own ignorance.

Mr. Lowe—I do not think you are quite right. I did seek information from the compressor builders, thinking they would know about it. To specific problems they gave replies, and went to some trouble to work out problems for us. I am satisfied Mr. Oliphant has a great deal of information on the subject. Now that he has published a formula intended to be as simple as possible, it shows his good intentions. From other sources I was unable to obtain anything more than a solution of problems, largely from machine builders who hoped to sell us their product. We consulted all sources of information we could find, including experiments with compressed air over 5 or 6 miles of pipe, and even then it was a matter of 2 or 3 years' work.

Mr. Martin—One rather peculiar thing in regard to our investigations of high pressure is that the results we obtained from this gentleman in Connecticut were within a fraction, say 1½ per cent. of being the same results obtained by the formula Mr. Lowe presents. His results were obtained by over 20,000 observations taken on pipe.

Mr. Doherty—The point I wanted to make is this. High pressures (and that is a comparative term) are new in the gas business, although they have been used for some time. The great advantages of high pressures, as advocated by engineers during the last 5 or 10 years, were not apparent by any formula, and they did not give us anything as a substitute for Pole's formula, and I hold that a knowledge of the flow of gas in pipes was not possessed by any of the engineers in the gas business, or else that they were very selfish in the use of that formula. Now your flow only goes up as the square root of your pressure, and before you get much increased conductivity by the use of high pressures your pressure has gone beyond all bounds. And while I am aware of the fact that high pressure gas distribution is with us to stay, it has been an evolution in which the cart has gone before the horse.

Mr. Lowe—I do not believe that any of the gas men, as we know them, had much knowledge of this subject, and surely I could not find any. In writing this paper my principal object was to call attention to two things: That you need have no fear as to very great injury to your gas because of compression, no matter what practical pressure; and that it is absolutely necessary to use long sweep fittings, and good long

ones at that, if you are going to get all the benefits of high pressure.

On motion of Mr. Martin a vote of thanks was tendered Mr. Lowe for his able paper.

Mr. John A Britton then read his paper entitled

FROM A CONSUMER'S STANDPOINT.

If you will brush away the cobwebs from your memory and revert in thought to the past, there will no doubt be recalled to your mind a scriptural injunction which has something to say concerning the removal of the beam from your own eye before you endeavor to remove the mote from your brother's. This is another way of stating that it is desirable that a man should put himself in another's place, and also to remind one of that immortal saying of Bobby Burns. The active gas man, whether he be behind the counter or mixing with the customers in the capacity of collector, statement taker or meter setter, is very apt to regard himself as entirely in the right when there may be chances of error on his part and right upon the customer. As in all other pursuits of life, there is no assurance that we can so conduct our business daily as to be certain of a uniformity in our methods, or our manners; nor, on the other hand, is there a certainty that the consumer against whom we run possesses the same uniformity of condition. A badly cooked breakfast, an aching tooth, a corn on the toe, a scolding wife, a bad case of indigestion or a night out with the boys the evening before, may all tend to make the consumer who enters your office with a complaint irascible, unreasonable and disagreeable. Your clerks and attaches may be in the same frame of mind from similar conditions. It is safe to assume that every consumer who complains has good cause. Generally it will be a local one, or it may be the result of a stirring up by contact with his neighbor. It may be the fact that there was presented to him this month a bill for $4.50 as against a bill for the previous month of $2.40, when neither he, nor his wife, nor family, can discover any reason why the bill for that month should have been more than the previous one. He honestly believes that he has used no more gas either for fuel or illuminating purposes; in fact he has been more economical than usual, has retired earlier, has had no company, or has been out visiting a large portion of the nights during the month; and his mind immediately becomes distorted with the idea that there is a bunco game afoot and that he is the particular sucker who is being buncoed by the irresponsible meter, and may God bless the meter's soul, for it has more sins to answer for than any other piece of mechanism invented by man. Building upon a proposition of defective registration there necessarily in his mind follows two series of conditions:

First—That the gas is poor and the pressure is bad; second—that the stove does not give out any heat, and smokes; and between the time that the bill is received and the time that he reaches the office he has thought out all sorts of problems and conditions and is loaded to the guards with what he believes to be facts, and perhaps we know deep down in our hearts that there is some cause for his complaint. We may know positively that the pressure did drop off the night before; that a little bit of thin gas got into the holder through some error of the gas maker; we may know that there is a drip upon his line that should have been pumped out the day before yesterday, but as soon as he begins to make his complaint up goes our hands in a defensive attitude and we are ready to box him off to the best of our ability. He sometimes succeeds, but more often we will talk him into paying the bill, and he goes away, as Dooley says, "With murder in his heart." We know (as this is a confessional we may as well be frank with each other) that in 90 par cent. of complaining cases the consumer has some foundation on which to build his complaint. Why not then put ourselves in his place, look at it from a consumer's standpoint and acknowledge to him frankly that we are in error and have our faults, and instead of demanding the usual pound of flesh give him some panacea for the wounds that we have unconsciously inflicted and which are smarting under his thought of injustice, instead of pouring salt into the wound and make it doubly agonizing. I know this may be regarded somewhat in the line of preaching and of the manifestations of a superior character of virtue; that it is possibly self-adulation, but isn't it fair? Every seller of a commodity, from shoe laces to houses and lots, endeavors to make friends with his customer by polite and careful attention and to gain his goodwill before consummating his trade by attractive methods and selling him goods at reasonable profit. We should remember that a consumer of every gas company is an integral part of the community in which he lives; that he has an influence, large or small, for good or for evil, and that his good graces should be cultivated to the extent of giving him credit for due honesty in his complaint and in his arguments. Naturally the ideal condition would be to so conduct the business that no one might have cause for complaint, but we all know that from the gas maker to the general manager there is a long train of human intellect, that all are liable to error, and while the intentions may be the best, it is simply an impossibility to have them work in synchronism. Once in a while some of them get out of step; perhaps it may be the man who is sent out to repair a leak; perhaps it may be an unguarded word of the collector, a sharp retort of your office man, or a bilious condition of your general manager, but they all tend to the same cause, to antagonize. Why not then so endeavor to conduct ourselves, and by force of precept and example so as to educate those who are in charge of our affairs to realize that the consumer is the one who furnishes the funds to make the business profitable, and as such he is entitled, upon the ground that he is a stockholder in your output, to be considered as reasonable in his demand. I am necessarily excluding from this condition the class of people that are met with everywhere who are unreasonable always, who can never be satisfied with honest explanations of difficulties, and whose hands are against everything and everybody. These men need a different sort of treatment; it requires the whirlwind, sledgehammer convincing positiveness to override and subdue them. These, like the poor, we have with us always, but they are very much in the minority.

If we will be alive and awake to our own shortcomings; if we will be honest with ourselves when we analyze conditions and know that we are at fault; if we will be willing to confess that fault—not only to ourselves but to our consumers—and then set about a correction of those faults, and be careful that the fault is not too often repeated, we can gain good repute with our consumers, and having once gained their esteem by truthful and honest exposition of your affairs by a fair and equitable concession to them when in the wrong, establish such a record that as time goes on complaining, dissatisfied customers will melt away as does the dew before the morning sun. It would be a good proposition if the gas men could be placed in the position occasionally of being consumers of some other gas company. It is a well known fact that there is no class of people more intolerant of errors in others than those who are constantly in error themselves. The greatost sticklers I have ever known in the gas business, and most unreasonable men to argue out a proposition of right or wrong concerning gas matters, have been men who were at some time or other in their lives associated with some gas company. To close as I began, remember the scriptural injunction to get the board out of your own eye before you attempt to remove the shavings from your brother's.

The paper was not discussed. A vote of thanks was passed to Mr. Britton.

ROUTINE BUSINESS.

The Secretary—Instead of the ordinary formal vote of thanks being passed to our host to-day, I think we should adopt proper resolutions showing our appreciation of the very great help that the Mechanics' Institute has been to us at this meeting. I have not had the time to prepare the resolutions, but if you will confide it to my care I will see that the proper resolutions are prepard for presentation to the Mechanics' Institute. [So ordered.]

The President—The "Experience Department" will have a hearing at the outing at Alum Rock to-morrow. Now, gentlemen, my task is done. It is with very great pleasure that I hand over this gavel to my respected successor. With the knowledge that my position has been a responsible one, as it is no less an honorable one, I will simply say that I have endeavored to do my duty in my humble way. and if I have in some measure succeeded in making this a successful convention, I am more than repaid for the many sleepless nights I have had. Gentlemen, I thank you for your attention.

President Lowe declared the convention adjourned until 7 o'clock P.M.

[To be Continued.]

Profit Sharing and Trade Problems.[1]

Although it has now become a commonplace to say that the example of the South Metropolitan Gas Company has proved the utility of the profit sharing system as it has never been proved before in this country, it must be admitted that this example finds little imitation, whether in the gas or any other industry. A few companies and individual employers have been infected with Sir George Livesey's enthusiasm. Here and there are works in which the system is being tried—sometimes with good and sometimes with indifferent results. But, speaking generally, profit sharing as an industrial policy does not make great headway. In theory, most employers would no doubt be found to agree with Sir George Livesey, that the existing wages system does not

1. Communicated to the *Journal of Gas Lighting*.

tend to get the best out of the men. Theoretically, too, most employees would gladly welcome a plan which would give them the direct interest in their work which few experience under present conditions. It is as true in one works as in another, that "if you can get the hearty and loyal co-operation of your people, you will do much better than if they are indifferent."

One knows only too well the workmen who in more than one sense may be classed as indifferent. Travelling the same dreary round year after year, they do just the absolute minimum of work, dawdling when the foreman is out of sight, needing a lot of preparation for starting, but keeping one eye on the clock and always ready to rush away when it is time to knock off. It is grudging, unwilling service, because no other kind of service seems called for. The interests of the man seem to him far removed from those of the master. So much or so little work for so much or so little pay practically sums up in such cases the whole relationship of capital and labor. Trades Unions do little or nothing to encourage a higher ideal. The philosophy of these associations is based on the principle of getting for their members the highest wages which can be squeezed out of the employers; and it is not doing all of them an injustice to say they encourage the "go easy" methods which keep the smarter workmen to the level of the slower men's stroke. From the worker's point of view, perhaps things do not look much better. He sees in the employer only one who is bent on exacting the utmost amount of toil, paying as little as he must, and caring no more for those whom he employs than for his machines—if, indeed, he cares as much. It is true that in large works it is impossible to maintain the personal relations of master and man which grew up in the small workshops of former days; but there is surely not much to be said for the system which has been evolved under modern factory conditions, in which there is, on the one hand, grudging service, and, on the other, indifference to all which concerns the worker, except his power as a producer.

Of the various devices for setting the relations of employer and employed on a better footing, profit sharing has the advantage of being most readily adapted to existing conditions of employment. It places no restriction upon the liberty of anyone. If there are good qualities in a man, it tends to bring them out; while it is free from those conditions of restraint which, it is to be feared, make certain of the best model village and other semi-philanthropic schemes a little irksome to some who experience them. Why, possessing these advantages, profit sharing makes such slow progress it is difficult to tell. One reason, no doubt, is the innate conservatism of both masters and men. The capitalist who finds things hard enough in these days of keen and increasing competition, may be forgiven if he hesitates to add 5 per cent. to his wages bill without reasonable certainty that it will come back in the form of larger output. On the side of the men, there are the Trades Unions, more or less openly hostile to any plan which may tend to weaken their power and influence.

While there is this general opposition to change which makes men rather "bear the ills they have than fly to others that they know not of," in special cases there are the difficulties which to Sir George Livesey and others who have surmounted similar obstacles may seem small, but to those whom they concern are real enough. There is the fear, first of all, of what the effect of proposing such a plan may have upon the workmen considered in the mass as members of a Trades Union. In trades in which the Unions exercise a dominant and almost tyrannical influence—and there are such, particularly in the smaller industries—the employer may question the expediency of making a change which might, for all he can see, strengthen rather than weaken the Union bond. In the second place, there arises the fear that to give more money to men who in ordinary circumstances do not show much wisdom in spending what they get, may only add to their opportunities of dissipation. Not much advantage will be got out of a profit sharing system if it only means that those who usually keep "St. Monday" will for a week or two each year have money wherewith to celebrate also "St. Tuesday" and possibly "St. Wednesday."

These may seem small obstacles; and the fact that they have been faced and overcome in connection with the South Metropolitan Gas Company and other large concerns, in which the workers represent a large variety of tastes and dispositions, is good reason for believing they might be surmounted in other cases. I have, however, in mind an instance in which these particular difficulties are very prominent. The trade is one of the smallest industries of the country—flourishing in its way, but dependent upon the demands of fashion and changes of seasons, and exposed, like most others, to keen foreign competition. One of the branches of the trade is of a highly technical character, demanding the exercise of no little skill and some thought. No machine has ever been invented to carry it out, and no machine seems likely to be, because of the particular care which is required in selection, which nothing but the eye and hand of the skilled workman are capable of exercising. These workmen, few in number, are organized in a Trade Union whose rules are so restrictive that no apprentice is allowed to be introduced. Naturally, the result is that the trade does not grow—in fact, if the present policy is persisted in, the time cannot be far distant when it will not only decay, but become absolutely extinct; and another of our industries will have migrated to France or Germany.

This is obviously not a case where tariff can help. What has to be overcome is not the competition of the foreigner, though this is a factor not to be ignored, but the obstinacy and wrong-headedness of British Trade Unionism in the exercise of its supreme strength. Combination among the employers might be a remedy; but such tentative efforts as have been made in this direction have broken down under the pressure of a little spurt in trade. The only alternatives in such a case—which is an extreme one—seem to be the introduction of foreign labor to fill the places which the Trades Union will not allow British workmen to occupy, or the conciliatory method offered by a system of profit sharing. The problem to be solved is whether profit sharing to the extent of 5 per cent. or so would be a probable solvent of such a difficulty, or whether it would not tend to intensify it, and make the workmen who are so much masters of the situation still more awkward to deal with. This is the question which faces one trade, and possibly more than one; and the fact that there is this kind of problem to be dealt with, may help to explain why it is Sir George Livesey has not more imitators. Perhaps he would say the very fact that there are such difficulties only proves the necessity for the adoption of his system as a remedy for them.

Production of Coke in 1903.

"W. L. C.," writing to *Iron Age* on this subject, says that the annual report in the United States Geological Survey upon the production of coke in 1903, which has just been completed by Edward W. Parker, records a slight decline in the quantity, but a substantial advance in the value of the year's output. There was also a very large gain in the number of coke ovens built during the year, and at the beginning of 1904 many more were in course of construction.

The statistics of the manufacture of coke as presented in this report include only that product which is obtained from the distillation or partial combustion of bituminous coal in ovens of the beehive type, or in retort ovens of which the coke product is suitabte for furnace and foundry use. The coke obtained as a by-product in the manufacture of illuminating gas and known as "gas house coke" is not considered in this report. Gas house coke is a spongy substance unfit for metallurgical use, and is consumed chiefly as a domestic fuel. Owing, however, to certain changes and developments that have taken place in the manufacture of coke in the last 10 years, it is necessary to include in these reports some ceke which is not manufactured for strictly metallurgical purposes. When the publication of the annual report, "Mineral Resources of the United States," was begun in 1882, practically all of the coke (except gas house coke) made in theUnited States was obtained from beehive ovens, the name of the oven being derived from the shape of the combustion chamber, which is similar to that of the conventional beehive.

Increase in By-Product Ovens.—During the last decade, however, there has been a steady and noteworthy increase in the construction of retort or by-product recovery ovens, the coke product of which is a high grade metallurgical fuel, although the coke itself is not in all cases the primary product. In some instances the coke is a secondary product, but cannot be considered as a by-product, like gas house coke. And while considerable quantities of the coke made in by-product ovens are sold for other metallurgical purposes, it is also true that manufacturers of beehive coke are now making a specialty of the preparation of coke for domestic use, and large quantities of this fuel were sold in 1902 to take the place of authracite coal, made scarce by the great strike of that year. It is impossible to make any separation of the coke sold for domestic use, and as the greater part of the by-product coke made is used for metallurgical purposes, it is considered as coming within the scope of this report, and it is no longer possible to limit the statistics, as formerly, to the production of blast furnace and foundry coke.

The coal consumed in the manufacture of coke in the United States is drawn from 6 of the 7 bituminous coal fields—namely: 1, The Appalachian field, embracing the great coking coal regions of Pennsylvania, Virginia, West Virginia, Ohio, Georgia, Alabama, Tennessee and Eastern Kentucky; 2, the eastern interior field, which includes the

coal areas of Illinois, Indiana and Western Kentucky; 3, the western interior field, including Arkansas, Indian Territory and Texas; 4, the Rocky Mountain field, including Colorado, New Mexico, Utah, Montana, South Dakota and Wyoming; 5, the Pacific Coast field, in which the only coking coals are found in the State of Washington. The coal of the northern interior field lying wholly within Michigan has not so far been used for coke.

A considerable amount of coke is made in States in which there are no coal fields—namely, Massachusetts, New York, New Jersey and Wisconsin. Construction work on a plant of 50 retort ovens was begun during 1903 at West Duluth, Minn. The ovens in Michigan and those recently constructed in Maryland (near Baltimore) are fed with coal from other States. With the exception of the few beehive ovens in Wisconsin, all of the plants outside of the coking coal fields are retort ovens. At the close of 1903 a plant of 80 retort ovens was under construction at Milwaukee.

Production.—The production of coke in 1903 showed a slight reaction from that of the previous year, during which time, because of the continued activity in the iron and steel trade and of the scarcity of anthracite coal, an unprecedented demand was created for coke. Including the production of coke from by-product or retort ovens, the total output in 1903 amounted to 25,262,360 short tons, as against 25,401,730 short tons in 1902. Considering the abnormal conditions which obtained in 1902, the continued large production in 1903 is noteworthy, and the slight decrease in tonnage is negligible. Compared with 1901, when the coke production amounted to 21,795,883 short tons, the output for 1903 shows a normal increase.

Notwithstanding the somewhat smaller quantity of coke made in 1903, as compared with the preceding year, the value of the product showed a substantial gain, increasing from $63,339,167 in 1902 to $66,459,623 in 1903, a gain of $3,120,456, or a little more than 5 per cent. The higher value for the coke product of 1903, as compared with the preceding year, was due to the unusual conditions which existed during the first few months of the year and which were left over as a legacy from 1902. It was not due to any healthful condition of the industry during 1903.

In considering the total value and average price for the entire coke product of the United States as presented in this report, it must be remembered that in many cases the values are arbitrarily fixed. A number of the larger manufacturers operate blast furnaces in connection with their coal mining and coke making business. In such cases the coke product is sometimes charged against the furnace departments at cost, and sometimes at a figure based upon the cost of coal mining and coke making, plus a percentage of profit on these operations. The value is not fixed by the market price. In other cases the value is estimated upon the average prices for coke of a similar quality produced and sold in the immediate vicinity.

Stimulated by the active demand for coke which prevailed in 1902, new construction was energetically carried forward, and during 1903 over 10,000 new ovens were added to those already built. At the close of 1902 the total number of coke ovens in the United States was 69,069. At the close of 1903 the number had increased to 79,187, a gain of 10,118.

The number of ovens idle during 1902 was 1,945, leaving a total of 67,124 active ovens, which produced 25,401,730 tons of coke, or an average of 378.4 tons per oven. In 1903 the number of ovens idle throughout the year was 1,999, leaving a total of 77,188 active ovens, which turned out 25,262,360 tons of coke, or an average of 327.3 tons per oven.

The total number of 77,188 active ovens in 1903 included 1,956 by-product ovens, which produced 1,882,394 tons of coke, or an average of 962.4 tons per oven. Deducting the number of by-product ovens from the total number of ovens active in 1903, it appears that there were 75,232 beehive ovens, which produced a total of 23,379,966 tons of coke, or an average of 311 tons each, or less than one-third the tonnage per oven by the by-product ovens operated during the year.

There were under construction at the close of 1902, 6,275 new ovens, of which 1,335, or about 21 per cent., were of the retort or by-product type. The number of completed retort ovens increased from 1,165 in 1901 to 1,663 in 1902, and to 1,956 in 1903. The output from retort ovens has increased from 1,179,900 tons in 1901 to 1,403,588 tons in 1902, and to 1,882,394 tons in 1903. In 1902, 5.5 per cent. of the total output was from by-product ovens; in 1903 the by-product coke was 7.4 per cent. of the total.

There were under construction at the close of 1903 1,335 new by-product ovens, which number constituted more than 20 per cent. of the total new ovens building at that time.

Details of Production.—The details of production of coke in 1903 are presented by States and Territories in the following table:

State or Territory.	Establishments.	Ovens Built.	Coal Used. Short Tons.	Coke Produced. Short Tons.	Value of Coke per Ton.
Alabama	39	8,764	4,483,942	2,693,497	$2.83
Colorado	16	3,455	1,776,974	1,053,840	2.93
Georgia	2	500	146,086	85,546	4.306
Indian Territory	5	286	110,088	49,818	4.57
Kansas	9	91	30,503	14,194	3.54
Kentucky	7	499	247,950	115,362	2.65
Minnesota	1	0	....	....	....
Missouri	2	8	3,004	1,839	3.15
Montana	4	555	82,118	45,107	6 89
New Mexico	2	126	18,613	11,050	2.85
Ohio	8	440	211,473	143,913	3.67
Pennsylvania	212	40,092	23,706,455	15,639,011	2.49
Tennessee	16	2,439	1,001,356	546,875	3.12
Utah	2	504	....	....	....
Virginia	16	4,251	1,860,225	1,176,439	2.315
Washington	6	256	73,119	45,623	4.71
West Virginia	136	15,613	4,347,160	2,707,818	2.628
Illinois	5	155			
Indiana	1	36			
Maryland	1	200			
Massachusetts	1	400			
Michigun	2	75	1,306,707	932,428	3.46
New Jersey	1	100			
New York	3	40			
Wisconsin	1	228			
Wyoming	1	74			
Totals	500	79,187			

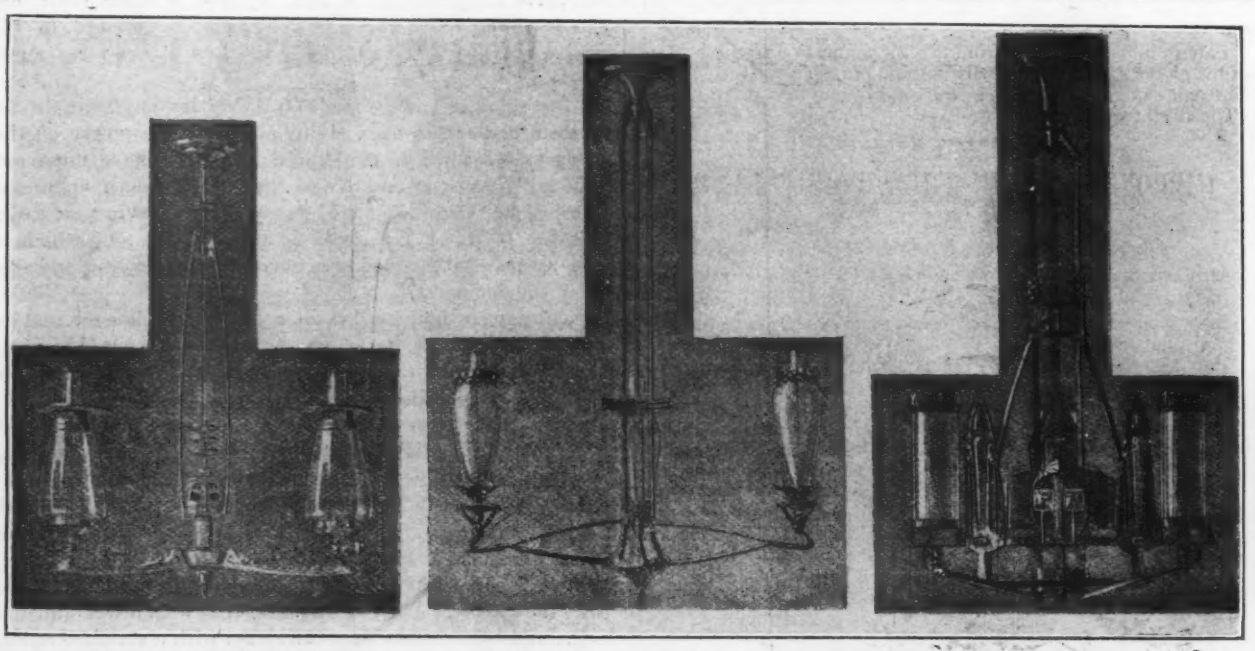
In order to produce the 1,882,394 tons of coke there were used in the by-product ovens in 1903 2,605,453 short tons of coal, showing a yield of coal in coke of 72.25 per cent., a much larger yield than is or can possibly be obtained in the operation of the beehive ovens. As previously shown, the average yield of coal in coke for all the United States (including the output of by-product ovens) in 1903 was 64 per cent., and this is probably higher than the results actually obtained.

In 1893 the first plant of by-product recovery ovens in the United States was completed at Syracuse, N. Y. At the close of 1903 there were nearly 2,000 ovens in operation, the plants being distributed through 10 different States. Of the 1,335 ovens building at the close of 1903, 250 were distributed among 3 new States—Illinois, at South Chicago; Minnesota, at West Duluth, and Wisconsin, at Milwaukee. When all of those new ovens are completed, making a total of 3,291 by-product ovens, their production, at an average of 1,000 tons per oven per year, will be equivalent to 13 per cent. of the total product of the United States in 1903. In 1902, 5.5 per cent. of the total production of coke was made in by-product ovens. In 1903, 7.4 per cent. of the total was by-product coke.

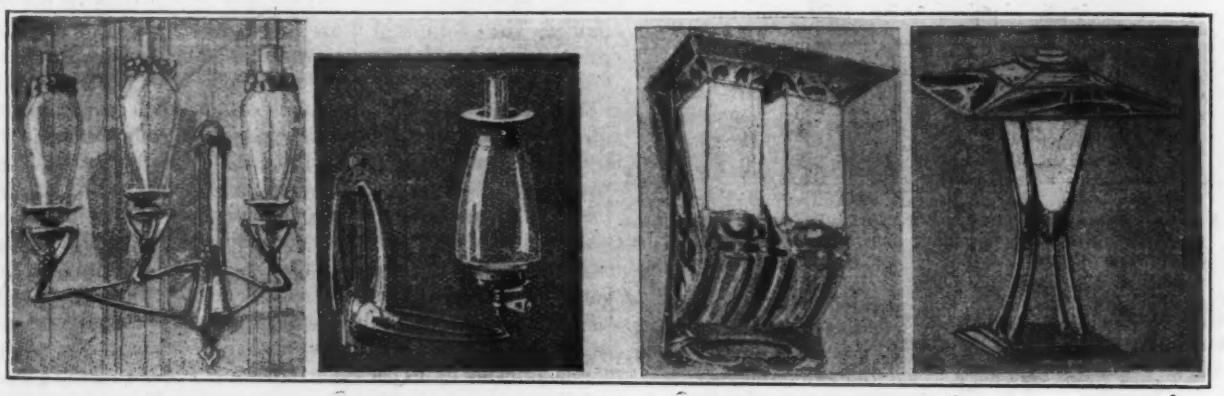
The Design of Gasfittings.

The *Journal of Gas Lighting* notes that at the beginning of 1903, the German Society of Gas and Water Engineers instituted a prize competition for the design of gasfittings which should be at once useful and highly artistic. The designs were to be submitted in sets of three, comprising a pendant for 3 to 6 lights, a wall bracket for 1 to 3 flames, and a table lamp; and each design had to be accompanied with full sized working drawings, in section, etc., of the apparatus suggested. Four prizes were originally offered; one each of 1,000, 700, 500 and 300 marks. The models, 126 in number, were first exhibited at the meeting of the Society which was held at Zürich last year, and they were afterwards taken round to a considerable number of the larger German towns, and placed on exhibition there also. The six judges finally decided to alter the arrangements governing the awards, finding it preferable to give two equal first prizes of 600 marks, two second prizes of 500 marks, one third of 300 marks, and 3 lower grade awards of 200 marks each.

According to Professor Gmelin, the Editor of *Kunst und Handwerk*, who has criticized the exhibits at some length, the best designs submitted to the judges were favorably characterized by the plainness and simplicity of their lines; the fittings that received the highest awards being such as would not have met with general approval 25 years ago. It is only recently that the fantastic and over-decorated patterns of bygone days have given way to severity—a change which is the more welcome because of the way in which the electric light lends itself to unpretentious pendants or supports. For instance, in the two 3 light pendants that received the first prize, the tube conveying the gas was honestly divided into 3 pieces, each supplying a burner, or a single central tube was surrounded by three slightly bent rods to give greater breadth and rigidity; while the connections between the base of the



First Prize—Ortlieb, of Berlin. First Prize—Fehse, of Berlin. Second Prize—Franke, of Berlin.



First Prize—Fehse, of Berlin. First Prize—Ortlieb, of Berlin.

pendants and the burners were made with simple straight or curved tubes, not loaded with showy leaves or scroll work. In some of the less satisfactory designs, the glassware of the burners was slung from above instead of being supported from beneath. Professor Gmelin holds this to be an artistic error. A gas burner must be supplied with gas from beneath the flame, and the leading tube is nothing to be ashamed of. The plan of bringing the pipe down inside the globe is therefore a species of deception. When, moreover, the globe is made with no opening at its base, there is no convenient place for the necessary cock, no aperture for the admission of air to the flame, and the whole device becomes a wanton imitation of the electric glow lamp. When glow lamps were first introduced, they were always carried from underneath, because that was the custom with gas lights; but now that the advantage of a depending glow lamp is everywhere apparent, the designers of gasfittings feel compelled to copy the idea blindly. This is not art or common sense, for everything should be treated in the way that suits it best, and should not be forced to masquerade in borrowed attire. Professor Gmelin is obviously referring only to the burner which is itself upright; he makes no reference to the inverted arrangement.

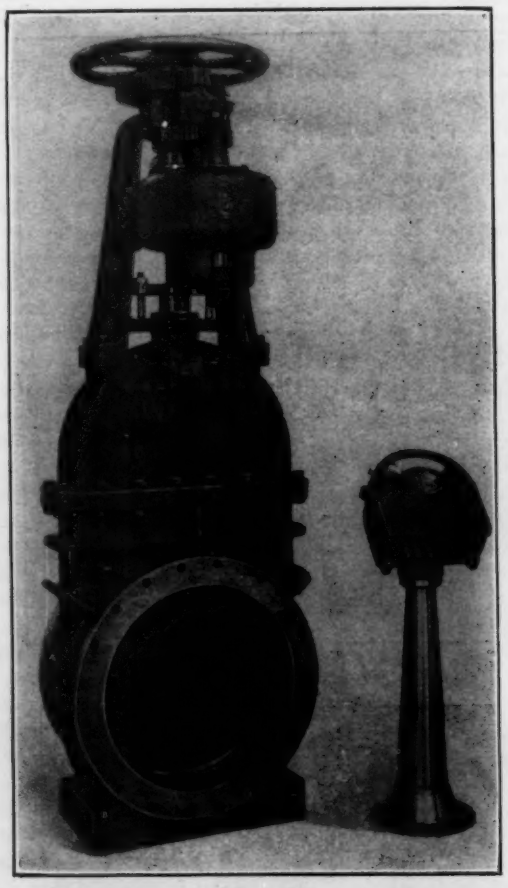
An Electrically Operated Valve.

As all engineers in charge of the operation of large power plants well know the valve equipment is one of prime importance, and the means for actuating them are only secondary. Up to a certain point hand manipulation will suffice if the valve may be reached in any sort of comfortable fashion, but for very large sizes it becomes necessary to employ mechanical means to open and close them. Hydraulic, pneumatic and steam operated valves all have their limitations, and a demand has arisen for valves operated by electric motors, due to their peculiar advantages. This has led the Chapman Valve Mfg. Company of Indian Orchard, Mass., to adopt this arrangement, as it offers a practical means for rapidly handling large gate valves or sluice gates under ordinary conditions, and especially in cases of emergency.

In the designing of such apparatus the conditions governing the application of the electric motor to the valve were found to differ entirely from its application to all other machinery, inasmuch as the travel is limited to the size of the valve opening. The difficulties of the problem were overcome by the use of a series wound motor especially adapted for the purpose, in connection with a lost motion device, enabling it to attain practically a runaway speed. On account of its winding, the motor exerts a heavy torque in starting, striking a hammer blow which insures unseating the valve. The electric operation also makes possible automatic indicating and controlling devices, no matter how remote. Valves of this class are especially suited for water, steam and oil lines, and for low pressure work, such as exhaust and condenser piping, pump sections and discharge sewage and irrigation systems. They are also extensively used on the receiver piping of compound and triple expansion engines and are rapidly coming into use as throttle valves on steam turbine units.

The Chapman gate valves are of the double faced, solid wedge, plug type, and have a straightaway passage the full diameter of the connecting pipe. This is the simplest and strongest design for the purpose. It requires the smallest number of working parts and offers the least resistance to the passage of the fluid. These valves have been carefully designed, and while retaining the general features which distinguish valves of this make have in addition certain improved ideas in valve construction. They are intended to withstand hard usage and the design may be readily modified to meet special requirements. The compactness and simplicity of construction of the patented arrangements enable the use of a very small motor, which is, however, large enough to open the valves under all conditions, and in closing there is no danger of forcing them to their seats so tightly that they cannot be easily opened without resorting to hand power. They are made in all sizes from 6 to 72 inches and for both direct and alternating current, any voltage, phase or frequency.

The accompanying illustration shows a 24-inch Chapman valve with a General Electric motor and the controller for remote control. With this device the valve may be controlled from any desired point and the exact position of the gate is indicated at all times. The valve may be opened or closed any fractional amount by moving the controller handle to the corresponding point. When the gate has reached this



A 24-Inch Electrically Operated Valve and its Controller.

position the motor is automatically cut out. In case of an emergency the valve may be opened or closed, as desired, by pressing one of the numerous buttons, located at different points about the station. This starts the motor, and when the valve is fully opened or closed, as the case may be, the circuit is automatically broken.

The apparatus illustrated may be seen in operation at the General Electric Company's exhibit, Space 26, Palace of Electricity, World's Fair, St. Louis, Mo.

The Heat Value of Gas Engine Exhaust Gases.

In a paper read by Mr. B. Hopkinson at the recent meeting of the British Association on the "Calorimetry of Exhaust Gases," and for what follows of it, the *Gas World* admits its indebtedness to an abstract published by *Engineering* in its issue for last week:

So far as I am aware, in all gas engine tests hitherto made, the indicated work, the heat in the cooling water, and the calorific value of the gas used are the only quantities which have been directly measured. The balance of heat unaccounted for has been put down to exhaust gases, radiation and conduction. In some cases an attempt has been made to separate the last mentioned items by estimation, but these attempts have been very rough in character, and have led to very divergent results. The special point of the tests to be described is that the exhaust gases were passed through a calorimeter, and so cooled to near atmospheric temperature, the heat rejected by them being measured. In this way a complete heat account has been obtained, in which the only item not directly determined is the loss by conduction and radiation.

The first set of tests were made on a Crossley engine in the Engineering Laboratory, Cambridge, giving about 5-horse power on the brake. This engine is several years old, and its performance must not, therefore, be taken as representative of the more modern engines made by the same firm. Cambridge coal gas was used, having an average calorific value of 680 B.T.U., at 0° C. and 760 mm., of which about 70 B.T.U. are the heat evolved in condensing and cooling the steam produced in the explosion.

The calorimeter used consists of a section of flanged cast iron pipe fitted with baffle plates, by which the gases are caused to pass several times backwards and forwards through its length, and finally to bubble through the water collected at the bottom. The water, after passing through the jacket surrounding the calorimeter, meets the exhaust gases in a fine jet, and is partly caught by them and carried round with them, and partly trickles down the baffle plates. It was found that in this way the gases could be cooled, with the engine fully loaded, down to 120° F. or less, the cooling water rising in temperature from about 60° to 90°.

Some pains were taken to secure accurate measurement of the heat put into the engine. The gas was measured with a wet and dry meter in series, and both meters were calibrated with a standard holder at the rate of flow of gas actually used. The calorific value of the gas was determined with a Junkers calorimeter at the time of the test on the engine. The amounts of heats stated as having been supplied to the engine are probably correct to within 2 per cent.

The following are the results obtained. (See table at foot.)

Explanation of Table.—The fifth column is an estimate of the energy still left in the exhaust gases after passing the calorimeter in those cases in which it is not negligible. It is based on the assumption that the volume of gas discharged per cycle is that the engine stroke, corrected for the suction pressure (observed) and the suction temperature (assumed), and that these gases are saturated with water vapor. The temperature is observed, and thence can be calculated the heat which they would evolve (by cooling and condensation of steam) on cooling to 80° F., which is about the temperature at which the gases leave the Junkers calorimeter. This estimate is a very rough one, as the volume may be in error by 10 per cent. in certain cases, and the gases may not be fully saturated; but the item is a very small one.

In the first three trials, as appears from the seventh column, there was no load on the engine, and practically all the explosions were preceded by one or more scavenging strokes. In the other trials the engine was nearly fully loaded, so that very few of the explosions were preceded by a scavenging stroke. The release pressure in the eighth column is the pressure at a point one-tenth of the stroke short of the out-center, at or about which point the exhaust valve begins to open. The energy of the gases at release is calculated from the release pressure on the assumption that we have then perfect gas mixed with the steam produced by the explosion, the amount of which is known from the gas analysis. The heat of condensation and cooling of this steam is added to the heat in the gas considered as perfect gas. The actual energy is probably more than this, since the steam and CO_2 are almost certainly somewhat dissociated at the temperature of release. In the tenth column are the temperatures of release. These are calculated from the suction temperature (assumed) and release pressures. In the case of the light load trials the suction temperature cannot be far different from the temperature of the gas before admission, and I have taken a round

No. of Trial.	Heat Value of Gas, B.T.U. per Explosion.	Indicated Work, B.T.U. per Explosion.	Heat to Jacket Water.	Heat to Exhaust Calorimeter.	Heat up Chimney.	Balance Unaccounted-for.	Explosions per Minute.	Release Pressure. Pounds per Square Inch in Absolute.	Energy of Gases at Release. B.T.U. per Explosion.	Release Temperature.	Liner Temperature.	Temperature of Jacket Water (Exit.)	Temperature of Exhaust Gases after Passing Calorimeter.	
		p.c.				p.c.				Degs. C.	Degs. F.	Degs F.	Degs. F.	
1	13.3	2.5 = 19	5.5	4.0	..	1.3 = 10	32	49	6.4	780	102	72	80	.....
2	18.5	3.4 = 18½	8.3	5.2	..	1.6 = 8½	23	53	7.5	870	106	72	80	.....
3	16.0	2.9 = 18	6.4	5.2	0.4	1.1 = 7	32	56	7.7	930	86	70	100	Late ignition.
4	13.0	2.7 = 21	5.1	4.1	0.1	1.0 = 8	110	46	6.0	900	122	80	105	.....
5	12.6	2.5 = 20	4.2	4.6	0.1	1.2 = 9½	117	43½	5.5	800	156	200	105	.....
6	15.1	2.9 = 19	5.9	4.2	0.2	1.9 = 12½	116	45	6.0	880	126	92	118	.....
7	15.0	2.8 = 18½	6.4	4.0	0.1	1.7 = 11½	120	45	6.0	880	126	81	112	.....
8	16.5	2.7 = 17	6.4	4.3	0.1	2.6 = 16	91	53	7.2	1,250	103	75	107	Late ignition.
9	15.2	2.65 = 17½	5.7	4.2	0.4	2.2 = 14½	111	52	7.0	1,200	100	82	144	Late ignition.

All the figures are stated in British thermal units per explosion, and the first four columns need no further explanation.

figure of 27° C. or 300° absolute. In the full load trials the suction temperatures are very uncertain. I have drawn on Professor Burstall's measurements for these, and have assumed a round figure of 77° C. (350° absolute) for Nos. 4, 5, 6 and 7, and 127° C (400° absolute) for the others, in which the release temperatures are higher. It will be seen that the temperature measurements are extremely rough, but I have only based conclusions on their relative order of magnitude in the several trials, and that is, no doubt, correctly shown. The "liner temperature" is that of the outer end of the cylinder liner where it projects in front of the cylinder. Since this portion is not water-jacketed, is not exposed to the flame, and is in all trials, except No. 5, hotter than the jacket water, it must receive its heat entirely from the piston, which comes into contact with it on the out-center. Its temperature is, in the case of the full-load trials, a rough indication of the heat being given to the piston. In trials Nos. 3, 8 and 9 the ignition was retarded, so that it commenced about one-thirtieth of the backward stroke after the in-center. In the other trials the ignition was normal and commenced slightly before the in-center.

Points to be Noted.—The following points are worthy of note:

1. The gases lose much heat between release and entering the calorimeter. The following table shows the difference between the estimated energy at release and the energy given to the calorimeter, and sent up the exhaust pipe. The actual difference is greater, since, as already explained, the energy at release is certainly underestimated.

Number of trial.....	1	2	3	4	5	6	7	8	9
Release temperature....	780	870	930	900	800	880	880	1,250	1,200
Temperature of passages	cold	cold	cold	hot	hot	hot	hot	hot	hot
Loss in passages.....	2 4	2.3	2.1	1.8	0.8	1.6	1.9	2.8	2.4

The gases lose heat after release, partly in the exhaust valve and passages, and partly to the cylinder walls in the exhaust stroke of the piston.

2. The balance unaccounted for (column 6 of table) seems to consist mainly of radiation from the exhaust valve.

3. There is no marked improvement in efficiency caused by scavenging.

4. The piston is cooler with the late ignition.

One object of these trials was to ascertain whether a practical method of testing gas engines for efficiency could be based on the calorimetry of the exhaust gases.

To measure the heat put into a large engine worked with producer gas is a very difficult and costly undertaking. The volume of gas is very great, and its quality may vary largely in the course of a day's trial. It seems to me that it may be easier and more accurate to measure the indicated work and the heat rejected, as is usually done in testing a steam engine. One large part of the rejected heat—that is, the heat in the jacket water—presents no difficulty; we have therefore only to measure the heat carried away in the exhaust gases.

The only question is whether the balance or heat unaccounted for, which cannot be measured, is too large a percentage of the total heat. From this point of view the tests made on the small Crossley engine are not very satisfactory, the heat unaccounted for in the full load tests ranging from 8 to 16 per cent. of the total. Moreover, in these tests the calorimeter was very much more bulky than was necessary for the purpose. It appeared to me from consideration of the results that the lost balance of heat must have gone mainly in radiation from the exhaust valve and other uncooled parts of the engine. I, therefore, made a similar trial on a second and larger engine in the laboratory, in which, as it had a water cooled exhaust valve, it appeared probable that the radiation loss would be substantially less.

This engine is by the Forward Engineering Company, and gives about 10-horse power on the brake. In the case of this trial the exhaust gas calorimeter was made very much smaller. The water is sprayed through 2 flat flame gas burners into the exhaust pipe, so that the exhaust gases immediately on leaving the engine encounter a sheet of cold water, and they are further cooled by churning up the water at the bottom of the calorimeter. With this apparatus the gases were cooled down to a temperature of 120° F. or less, the engine being fully loaded. The following are the results of a trial made on this engine.

	B.T.U. per Explosion.	Per Cent.
Jacket water.....	7.0	32
Exhaust calorimeter	7.5	34.5
Heat up chimney (estimated)..	0.3	1.5
Indicated work.....	5 7	26
Balance unaccounted for.....	1.3	6
Heating value of gas used....21.8		100.0

Temperature of exhaust gases after passing calorimeter, 107° F.

Temperature of jacket water at exit = 105° F. Explosions per minute, 106. Indicated horse power = 14.2.

The gas measurement in this trial is correct to within 2 per cent. The indicated power is correct to within 5 per cent., ahd the other measurements to within 2 per cent.

It will be seen that the heat lost by radiation and conduction certainly does not exceed 10 per cent. of the heat put into the engine, and is probably a good deal less. I have made a large number of trials of the same kind on this engine, in all of which the balance unaccounted for is less than 6 per cent. even when the jacket water was very hot. This seems to me a sufficiently good result to justify trying this method of testing engines on a larger scale, especially having regard to the very compact character of the exhaust gas calorimeter. There is no doubt, I think, that the secret of success is to spray a sheet of water under high pressure into the exhaust pipe close up to the engine. The gases rushing out break up this sheet into minute drops, and are thus very effectually cooled. The only difficulty, then, is to separate the suspended water from the gas, and to collect and measure its amount and rise in temperature, but that separation is by no means so difficult as I had anticipated. It will be found, on calculating out the heat contained in the gas after leaving the calorimeter, that this item does not become seriously high so long as the temperature of the gases is below about 140° F. I find, however, that the radiation and conduction from this particular calorimeter become rather large at temperatures above 115°. But it is easy to determine the amount of this by a separate experiment.

SPECIAL ENGLISH CORRESPONDENCE.

COMMUNICATED BY NORTON H. HUMPHRYS.

SALISBURY, ENGLAND, Sept. 10th, 1904.

Coke Oven Gas.--Radiant.—The Orystal Palace District Gas Company and Carburetted Water Gas.

The town of Royston in Yorkshire is entitled to claim the honor of witnessing the inauguration of a new departure, that possesses more of the element of business and common sense than many of the novelties that are put forward. It is also noticeable that the projectors of the scheme have actually found the capital and practically carried it out, which is the best possible proof of their confidence in it. A young man was once asked by an eminent literateur, "Have you sufficient confidence to lend me a guinea?" The reply was, "I have the confidence, but I haven't the guinea," and this fairly represents the position of the average inventor. Many good things are lost for want of the "ready" at the right moment. The subject of the present paragraph is the Royston Gas Company, Limited, and the special feature is that they buy coke oven gas, delivered at their premises, for 6d. per 1,000 cubic feet, pass it through a carburetter, and by such simple means, obtain the genuine 16-candle article which is in such general demand throughout the country. I purposely avoid the usual expression, delivered at the "works," because there are no "works" in the usual acceptation of the word. What plant they have is best described by saying that they start at the catchbox on the outlet of the purifiers. The gas as delivered has already been condensed, washed and purified, so they require nothing but the meter, the carburetter and the usual storing or distributing arrangements. Looking at the enormous quantity of gas produced in the process of making coke, and the large proportion that is allowed to burn to waste, one wonders that similar schemes have not been adopted long ago. Cheap benzol and efficient carburetters are by no means new creations.

The company starts with the modest capital of £10,000, and has a 15 million business to begin upon, and immediate prospects of another 20 millions. A notable feature in the new enterprise is that all internal fittings are supplied absolutely free. The only charge is a small rent for cookers or other stoves. Where would the gas industry be to-day if its pioneers had started on similar lines? The free fitting department is usually found to be indespensable in the supply of electricity and the general trend of business is all in that direction. The "nimble ninepence" becomes more and more sought after, and people nowadays freely spend 8d. or even 8½d. to get it. The selling price of the new gas is to be 3s. 9d. per 1,000 cubic feet to begin with, but as there is no precedent available the company cannot tell what their working costs will be until they have had some practical experience.

The scheme being new, one does not care to criticize the financial aspect too closely, but it is difficult to see where any large advantage comes in as compared with coal gas as usually made. Coke ovens are always located in colliery districts where coal is cheap, and if a suitable coal is available a good quality gas can be put into the holders ready for distribution at a net cost of considerably less than 1s. per 1,000 cubic feet, which does not compare unfavorably with a poor gas at 6d. plus the cost of benzol enrichment. And it must be remembered that

after all the coke oven gas is only a by-product. What would be the position of the Royston Gas Company if the concern supplyIng them with oven gas found themselves overstocked, or from any other cause under the necessity of shutting down for a few months?

A paragraph has been going the rounds of that section of the daily press that depends upon hearing or telling of some new thing, extolling the virtues of a new material, which is oddly decribed as threatening the gas industry. Such description of it as is forthcoming even from the inventors themselves is inaccurate to the verge of absurdity. The new terror to the gas industry is nothing more or less than a substitute for the asbestos balls or iron fret used in incandescent gas fires, and the idea seems to be that just as the incandescent mantle secures a larger proportion of the total energy in the form of light, so the new material, which is called "radiant," recovers a larger proportion of the heat in the form of radiant heat. In what way a material possessing such wonderful properties can harm the gas industry is not at all obvious. Assuming all that is claimed for it to be correct—which is very doubtful—it will take a similar position as regards the gas fire that the incandescent burner occupies as compared with the flat flame. More than that, it will have the important and far reaching effect of solving the gaseous fuel difficulty, by rendering gas at ordinary prices cheaper than coal. No gas engineer will regard such a material with feelings other than enthusiastic welcome. But from a business point of view it would be better to advertise the new material by practical demonstration—it is a very simple matter to take two gas fires of similar pattern, arrange for each to receive equal quantities of gas, pack one with asbestos and the other with radiant—than by means of obtuse paragraphs that are not free from inaccuracies as regards elementary science. Not the least amusing feature is that the editors of our gas periodicals lost no time in applying for specimens of the material, and in reply received a chip about the size of a pea. Perhaps on account of the minuteness of the sample, neither of them appears to be much the wiser in respect to "radiant" than they were before.

In the course of last July a circular of an unprecedented character was issued to the consumers by the Crystal Palace District Gas Company, in which they stated in effect that they intended to rebel against Parliamentary restrictions in respect to sulphur other than sulphuretted hydrogen, and illuminating power. Many companies have been complaining for years in respect to some of these restrictions, which are useless and necessitate unnecessary expenditure; they have pointed out the injustice of being handicapped while the purveyors of oil, candles, electricity and coal enjoy an asbolutely free hand and are at liberty to suit the quality of their specialties to the exigencies of the market. Even when common sense was obviously opposed to such restrictions, there has hitherto been supposed to be no remedy. Grumbling there has been and plenty of it, but no one has cared to face the responsibility of taking the law into their own hands. The circular states plainly what the Company propose to do and why they are going to do it, and has been very capably and clearly drafted, possibly in view of legal proceedings. Having mentioned that the Company have been proceeded against for creating a nuisance at the works, the cause of such nuisance is traced to the use of lime in purifying and to the manufacture of carburetted water gas. The first is necessitated by the legal limitation in respect to sulphur, and the second by the same in regard to illuminating power. Then follows a somewhat severe criticism of water gas, which is stated to be more injurious than simple coal gas in case of leakage, very inferior for heating purposes, and when mixed with coal gas it seriously diminishes the efficiency of gas fires and stoves. Simple coal gas is stated to be better for engines and for incandescent burners. Seeing that the use of lime and the manufacture of water gas involve inconvenience and annoyance over a wide area in the vicinity of the gas works and the committing of nuisance that is in fact a breach of the law, the directors have unanimously decided that out of all evils they must choose the least and follow the course that is really more nearly in accord with the interests of the consumers.

With the main features of the circular the whole of the gas industry will be in sympathy, as they would only be too pleased if this original method of dealing with legislation of a grandmotherly kind should prove to be successful, and whatever the outcome they cannot but admire the ability and skill with which this plucky departure has been carried out. But I need scarcely add that the strictures on water gas have not been accepted with equal grace, especially by the numerous companies who supply 30 or that to 50 per cent. of water gas. The Crystal Palace Gas Company no doubt would have preferred to avoid reference to the qualities of water gas, but at the same time they were bound to give chapter and verse for wishing its discontinuance. They do not want to make water gas and therefore are none too charitably disposed as regards its defects. Other companies—I might say 99 out of 100—*do* want to make this description of gas and therefore tend to the other extreme. I have remarked that under the circumstances the Crystal Palace Company could not avoid stating their opinions, but the obvious result is that others are equally under a necessity to justify their continuance of its use and to issue something of the nature of a counterblast. The circular is intended to be of the nature of a privilged communication as between company and consumer, but in practice it cannot be divested of the character of a public announcement made on high authority.

In one respect the vigorous references to water gas are not to be regretted. One way of finding out how many friends a man has, is to take up an antagonistic attitude towards him. And so the result of the circular has been to draw out a great deal of interesting detail as to the reasons which have led other gas companies, after prolonged experience, to continue and even to extend the use of water gas. Not only has it been ably considered as applied to individual undertakings, but from a national point of view. Perhaps the strongest points in its favor are that the result of its adoption have in round figures reduced the demand for gas coal to the extent of 2,000,000 tons per annum and lifted about 1,500,000 tons of coke out of the market, to the marked benefit from the board room point of view of both coal and coke traders. It would be a difficult task to belittle the importance of the statistics quoted in support of this contention. Another point is that in respect to their experiences of water gas manufacture the Crystal Palace Company are as startlingly original as in their attitude towards Parliament. No other company has experienced the disadvantages set forth, or having once embarked in water gas plant desired to discontinue and reject it.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

MR. GEORGE A. DOUGHTY has been appointed Assistant Secretary of the Logan Iron Works, Brooklyn, N. Y.

WE are indebted to the Green Fuel Economizer Company, of Matteawan, N. Y., for a copy of its new descriptive pamphlet; of course it has to do with the Company's apparatus, and it deals with the details thereof with precision and thoroughness.

CERTAIN well-equipped capitalists have given notice of their intention to apply for a charter for a gas company to operate in the boroughs of Kennett Square, Avondale, West Grove, Malvern, Paoli and Berwyn, Chester county, Pa.

IT is said that certain Chicago "short capitalists" have applied to the authorities of Roswell, New Mexico, for the right to operate a gas works in the named place. The applicants declare that they wish no contract with the authorities on public lighting account, and that they will supply gas for ordinary use and service at the rate of $1.25 per 1,000. The correspondent who forwarded the information closes his narrative with the remark that the city "Has everything to gain in this proposition and nothing to lose through it," in which assertion we agree. The losers would likely be the men from whom the "short capitalists" got the money to build the plant. Roswell will not be ready to support a legitimate gas works for many years.

AT the annual meeting of the shareholders in the Worcester (Mass.) Gas Light Company, the Directors elected were: Charles D. Lamson, A. G. Bullock, Francis H. Dewey, Albert Wood, Samuel B. Woodward and Thomas B. Eaton—the latter succeeds the late Mr. J. H. Clarke. The Directors subsequently perfected the following organization: President and General Manager, Chas. D. Lamson; Treasurer and Clerk, James P. Hamilton.

MR. E. P. FINCH has resigned the position of General Manager of the Fox River Valley (Wis.) Gas and Electric Company, the same to take effect the 30th inst. He takes charge at Negaunee, Mich., the 1st prox.

THE Harrison Gas and Coke Company's promoters have applied to the authorities of Harrison, O., for an enabling franchise.

AT the annual meeting of the Welsbach Company held in Gloucester, N. J., the afternoon of the 14th inst, the report showed that the business for the past twelvemonth had been of a most satisfactory nature. The Directors elected were: Sidney Mason, Thomas Dolan, Samuel G. Bodine, Randal Morgan, W. W. Gibbs, Walton Clark, E. W. Spencer and Lewis Lillie.

THE additionss to the plant of the Brockton (Mass.) Gas Light Company have been satisfactorily completed,

MR. JAMES TRIMBLE has been appointed Manager of the plant at Alpena, Mich. His successor at Rapid City, So. Dak., is Henry Birnbaum.

THE property of the Peoples Gas and Electric Company, of Stoneham, Mass., was sold at mortgage sale some days ago. The purchaser was Mr. W. E. Barrett, of Boston, Mass., at his bid of $5,000.

A CORRESPONDENT in Enid, Oklahoma, writing under date of the 15th inst., says: "The Order of Elks celebration to-day was of the royal sort, and prominent in the pageant was a series of floats illustrating what could be done in certain ways by named means. The second float gave an exhibition of the modern way of cooking over the old-time way. It was prepared by the proprietors of the Enid Gas and Electric Company, and a gas stove in actual operation was shown. Chef Rosch assisted by expert cooks was employed in baking biscuits, which were lavishly distributed to those who assisted in the inspection of the parade. On the rear end of the float two colored cooks were engaged in solving the problems presented in cooking through the agency of an 'old-fashioned' coal stove. Following this came the vehicles used in transporting the electric and gas repair crews, loaded with electricians and plumbers, and the final number in this especial part of the caravan was a carriage in which Manager H. H. White and Superintendent Rentchler, of the Enid Company, sat in state. The Enid Company is bound to be a go."

WE suppose this is not particularly new to the constructing fraternity, but our average reader will be interested to hear that the Cincinnati Gas and Electric Company has determined to expend about one-half million of dollars in the reconstructing of its West End plant.

THE shareholders of the Jeanette and Greensboro (Pa.) Gas Companies have agreed to consolidate their interests. The latter concern is of the natural gas sort strictly, and under the merger the successor is to be known as the Greensboro Gas Company.

MR. PEDRO A. BERNAL, of the United Gas and Electric Company, San Jose, Cal., has resigned from its service, to accept a responsible place with a prominent engineering firm in Buenos Ayres, S. A.

HERE is something forwarded us by an inspector and reader of gas meters, who works for a large Connecticut gas company: The master of the house was looking over the family accounts:

"U'm." he muttered presently to attract the attention of his wife. "Eliza and that young man of hers must be rapidly reaching a point where we may expect an announcement from them."

"Dear me!" exclaimed his spouse, in an ecstatic tremolo. "What makes you think so?"

"Just listen to these gas bills," he replied: "February, $4.33; March, $4.87: April, $7.42; May, $3.65."

"That is still Greek to me," said the wife.

"Nonsense!" said the man. "Can't you see that during the first 2 months there was a great rise, showing that he was late in leaving and this month there has been a decrease in the expense, because they have reached the point where they turn the light low whenever they sit in the parlor."

And that very night the prophetic acumen of the father was justified.

MR. F. DE V. THOMPSON and his wife sailed some days ago for France. All Springfield, Mass., knows who the voyagers are.

THE business offices of the Athens (Ga.) Gas Company are now in commodious quarters, No. 32 Clayton street, where Messrs. Maxon and March are ready to hear the complaints of their patrons and to receive their visiting gas friends.

THE project for an actual gas plant for Orange, Mass., is again under serious consideration. The place actually should have a gas supply.

NOW that the franchise for the continuation of the business life of the Excelsior Gas and Coke Company of Topeka, Kas., has been agreed to, the proprietors of the concern propose to expend something like $100,000 in betterments on the generating and distributing systems.

MR. J. B. HOWARD (better and well known to his old time brothers as "Uncle Jerry") would have us say that the new offices of the Galena (Ills.) Gas Company, which are located in the Telford Building, are quite up to anything that Col. Copley could select. He always has something on hand too that will quench a fire.

THE betterments on the plant of the Rochester (Minn.) Company have been completed.

THE Williams Valley Gas Company, a corporation for furnishing gas for lighting to the residents of Williamstown, Lykens, Williams and Wisconisco township, Pa., has been formed by Messrs. W. C. Chester and others. The headquarters of the Company are to be in Williamstown.

"W. M. C.," incloses the following, under date of the 16th inst.: The reports of the Boston Gas Companies for the fiscal year ended June 30, 1904, as made to the Board of Gas and Electric Light Commissioners, are summarized as follows: The "net" includes miscellaneous income, while the "surplus" is after interest, miscellaneous charges and dividends have been deducted.

	Gross.	Net.	Div'dends.	Surplus.
Bay State—				
1904	$546,336	$147,660	$100,000	$36,270
1903	521,938	70,875	....	70,875
1902	632,890	244,015	100,000	145,015
1901	503,595	199,432	210,000	*10,568
1900	586,755	193,127	210,000	*16,873
Boston—				
1904	1,240,419	232,753	125,000	69,361
1903	1,345,424	42,729	....	42,729
1902	1,107,088	140,000	150,000	*10,100
1901	1,130,246	240,885	300,000	*59,115
1900	1,062,701	306,845	287,500	19,345
Roxbury—				
1904	298,883	33,353	30,000	262
1903	312,237	4,108	....	4,108
1902	251,639	32,230	21,000	11,230
1901	241,134	37,622	42,000	*4,378
1900	233,145	45,743	45,000	743
South Boston—				
1904	150,251	11,640	13,200	1 680
1903	154,466	*16,517	....	*16,517
1902	131,293	10,591	8,800	1,791
1901	121,811	17,439	24,200	*6,761
1900	118,561	20,747	28,600	*7,853
Massachusetts Pipe Line—				
1904	525,869	130,975	50,000	10,370
1903	571,187	52,747	80,000	*27,253
1902	509,363	60,197	70,000	*9,803
Brookline—				
1904	1,084,815	459,686	200,000	80,254
1903	1,123,614	294,180	200,000	94,180
1902	919,481	212,625	200,000	12,625
Dorchester—				
1904	352,329	125,832	51,960	52,098
1903	373,152	100,706	51,960	48,746
1902	301,046	78,393	51,960	26,433
Jamaica Plain—				
1904	133,455	40,174	25,000	15,075
1903	136,040	46,536	37,500	9,036
1902	109,389	38,744	25,000	13,744

* Deficit

THE Boston *Globe*, of the 20th inst., had this to say: Judge Barker, of the Supreme Court, has entered his final decree in the gas case, dismissing without prejudice the bill brought by the Bay State Gas Company, of Delaware, through its Receiver, George Wharton Pepper, against the Boston Gas Light Company, *et. al.*, with a view to have set aside a sale of the stocks of the local companies by the Mercantile Trust Company in February, 1903, to Kidder, Peabody & Co. The plaintiff alleged that the sale was fraudulent in that the foreclosure under which it purported to have been made was brought about by an artificial default on the united gas bonds, to secure which the stocks of the companies had been pledged. In its decree the court says the sale of the stocks was legal and valid and the plaintiff was not entitled to relief. The decree continues:

"The Court did not hear or determine the question as to the rights of plaintiff to relief on account of the charges made by the bill, and particularly on account of any alleged breaches of trust by the defendant Rogers under the assignment from the Bay State Gas Company, of Delaware, to Rogers, Moore & Whitredge as Trustees on October 31, 1896, and on account of transactions of the defendant Whitredge and the Mercantile Trust Company in respect of the pledge in 1893 to the Mercantile Trust Company as Trustee of the 15,000 shares of the capital stock of the Bay State Gas Company, of Massachusetts.

"Counsel now waive the exceptions taken at the hearing, and the bill of exceptions filed in the case by the plaintiff has been discharged.

"Therefore it is ordered, adjudged and decreed that the bill be dismissed as against all defendants, but without prejudice to the rights of the plaintiff, if any, as against the defendant Rogers in respect of the alleged breach of trust, and particularly without prejudice to those rights set forth in a bill of complaint filed in the Supreme Court in a suit in equity now pending between the Bay State Gas Company, of Delaware vs. Rogers, and also without prejudice to the rights of the plaintiff, if any, as against Whitredge and the Mercantile Trust Company in respect to the above mentioned pledge of 15,000 shares of the stock of the Bay State Gas Company, of Massachusetts."

By the decree the fight as between the receiver of the Bay State Gas Company, of Delaware, and the local gas companies is ended, but the former will continue his fight against Rogers on account of the alleged breach of trust under the assignment from the Bay State Gas Company to him, Moore and Whitredge in October, 1896, and of the other transaction referred to in the decree. Receiver Pepper will seek to get from Rogers the damages he claims accrued to the Bay State Gas Company, of Delaware, from the alleged breach of trust.

THE AMERICAN GAS LIGHT JOURNAL

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NOTIFICATION RESPECTING ADVERTISING.

Orders for new advertising, or for changes in standing advertisements, to insure attention in the issue following their reception, must be in hand any time of Wednesday.

AGENTS:

New York—American News Co., 39 and 41 Chambers St.
Germany—Lemcke & Buechner, of New York.
England—Aug. Siegle, 30 Lime Street, London.

MONDAY, SEPTEMBER 26, 1904.

The Market for Gas Securities.

Realizing sent prices down last week all through the general market, and in common with the rest gas shares were quoted at lower prices. The general trading was good, in fact large, in volume, which shows that takers were in the market ready to absorb offerings by holders at considerable advance over the prices existing prior to the pronounced rise scored in the last fortnight. Consolidated closed to-day (Friday) at 203½ to 203¾, and the bidders evidently outnumbered the sellers. Rumor has it that there will be developments in connection with Mutual, of New York, before the New Year. While it is undoubtedly true that there should, with reason, be changes of some sort or another in its capitalization, those in charge are people of the slow sort, when it comes to a matter of "immediate distribution."

Brooklyn Union is nominally 218 to 223, but there is no trading in it. However, our idea that it will be 250 before the end of the year is still meant. Baltimore Consolidated keeps up its recent gain, but there does not seem to be much quick movement in the scheme for the amalgamating of the gas and electric interests of that city. It is bound to come, however: Cincinnati Gas and Electric is strong, and Peoples, of Chicago, is strongly held. Bay State is said to be somewhere in the "neighborhood" of seven thirty-seconds. The securities of the Public Service Corporation, of New Jersey, are in good demand at advancing prices.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY.

SEPTEMBER 26.

☞All communications will receive particular attention.

☞The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	Capital.	Par.	Bid.	Asked.
Consolidated	$73,177,000	100	203½	203¾
Central Union, Bonds, 5's	3,000,000	1,000	106½	106½
Equitable Bonds, 6's	1,000,000	1,000	105	..
" 1st Con. 5's	2,300,000	1,000	118	120
Metropolitan	658,000	..	108	112
Mutual	3,500,000	100	270	300
Municipal Bonds	750,000	..	..	..
New Amsterdam Gas Co.. Bonds, 5's	11,000,000	1,000	107½	109
New York & Richmond Gas Co. (Staten Island)	1,500,000	100	35	..
1st Mtg. Gold Bds. 5 p. ct.	1,000,000	..	.	.
Northern Union, Bonds, 5's	1,250,000	1,000	103½	105½
New York and East River.. Bonds 1st 5's	3,500,000	1,000	111	113
" 1st Con. 5's	1,500,000	..	106	108
Standard	5,000,000	100	125	130
Preferred	5,000,000	100	145	155
Bonds, 1st Mortgage, 5's	1,500,000	1,000	116	117
Yonkers	299,650	500	130	..
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	218	223
" " Bonds (5's)	15 000,000	1,000	118	115
Bay State	50,000,000	50	—	—
" Income Bonds	2,000,000	1,000	..	75
Binghamton Gas Works	450,000	100	28	30
" 1st Mtg. 5's	509,000	1,000	93	96
Boston United Gas Co.— 1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	4	4¼
" " Bonds, 5's	5,250,000	1,000	12¾	.
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	..	..
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	104¼
Cincinnati Gas and Electric Co	29,500,000	100	106¾	107
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	97½	99
Columbus (O.) Gas Lt. & Heating Co	1,689,780	100	88¼	89¼
Preferred	3,096,500	100	107½	109
Consumers, Toronto	2,000,000	50	200	204
Consolidated, Baltimore	11,000,000	100	..	80
Mortgage, 6's	3,600,000	..	..	118
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490 000	..	..	112
Consolidated Gas Co. of N.J.	1,000,000	100	15	17
" Con. Mtg. 5's	880,000	1,000	86	90
Consolidated G. & E. Co.'s. Little Falls, N.Y.	90,000	100	..	100
Bonds	75,000	..	..	100
Detroit City Gas Co	4,825,500	50	..	50
" Prior Lien 5's	5,603,000	1,000	99½	100
Detroit Gas Co., 5's	361,000	1,000	75	75½
" Inc. 5's	16,000	100	98½	100
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Essex and Hudson Gas Co.	6,500,000	..	39	40
Fort Wayne	2,000,000	..	..	..
" Bonds	2,000,000	..	35	..
Grand Rapids Gas Lt. Co. 1st Mtg. 5's	1,925,000	1,000	104½	105
Hartford	750,000	25	190	200
Hudson County Gas Co., of New Jersey	10,500,000	..	78	80
" Bonds, 5's	10,500,000	..	105¼	106
Indianapolis	2,000,000	..	66	70
" Bonds, 6's	2,650,000	..	103½	103½
Jackson Gas Co	250,000	50	82	.
" 1st Mtg. 5's	290,000	1,000	101	102½
Kansas City Gas Light Co., of Missouri	5,000,000	100	..	36
Bonds, 1st 5's	3,892,000	1,000	102	104
Laclede, St. Louis	10,000,000	100	..	..
Preferred	2,500,000	100	80	100
Bonds	10,000,000	1,000	109½	110
Lafayette Gas Co., Ind.	1,000,000	100	..	60
Bonds	1,000,000	1,000	60	65
Louisville	2,570,000	50	136	140
Madison Gas & Elec. Co. " 1st Mtg. 6's	350,000	1,000	107½	109¼
" 6 per cent. scrip, due 1910	100,000	25	85	87
Montreal, Canada	2,000,000	100	218	218¾
Nashville Gas Lt. Co.	1,000,000	100	110	..
Newark, N. J., Con. Gas Co.	6,000,000	..	56	58
Bonds, 6's	4,600,000	..	105	105¾
New Haven	1,000,000	25	64	70
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	101¼	103
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,000	1,000	..	..
2d "	2,500,000	1,000	104	..
Rochester Gas & Elec. Co..	2,150,000	50	88	..
Preferred	2,150,000	50	118	..
Consolidated 5's	2,000,000	..	87½	90
San Francisco, Cal.	15,800,000	100	58½	58¾
St. Joseph Gas Co. " 1st Mtg. 5's	751,000	1,000	94	96
St. Paul Gas Light Co.	1,500,000	100	45	47
1st Mortgage 6's	650,000	1,000	113	116
Extension, 6's	600,000	1,000	113½	115
General Mortgage, 5's	2,465,000	1,000	92	93
Syracuse, N. Y.	1,975,000	100	46	48
Bonds	2,047 000	1,000	94	96
Washington, D. C	2,600,000	20	287½	288¾
First mortgage 6's	600,000	..	..	..
Western, Milwaukee	4,000,000	..	..	..
Wilmington, Del.	600,000	50	120	..

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DIVIDEND NOTICE.

OFFICE OF THE UNITED GAS IMPROVEMENT CO.,
N. W. CORNER BROAD AND ARCH STS.,
PHILADELPHIA, PA., Sept. 14, 1904.

The Directors have this day declared a quarterly dividend of 2 per cent. (one dollar per share), payable Oct. 15th, 1904, to stockholders of record at the close of business, Sept. 30, 1904. Checks will be mailed.

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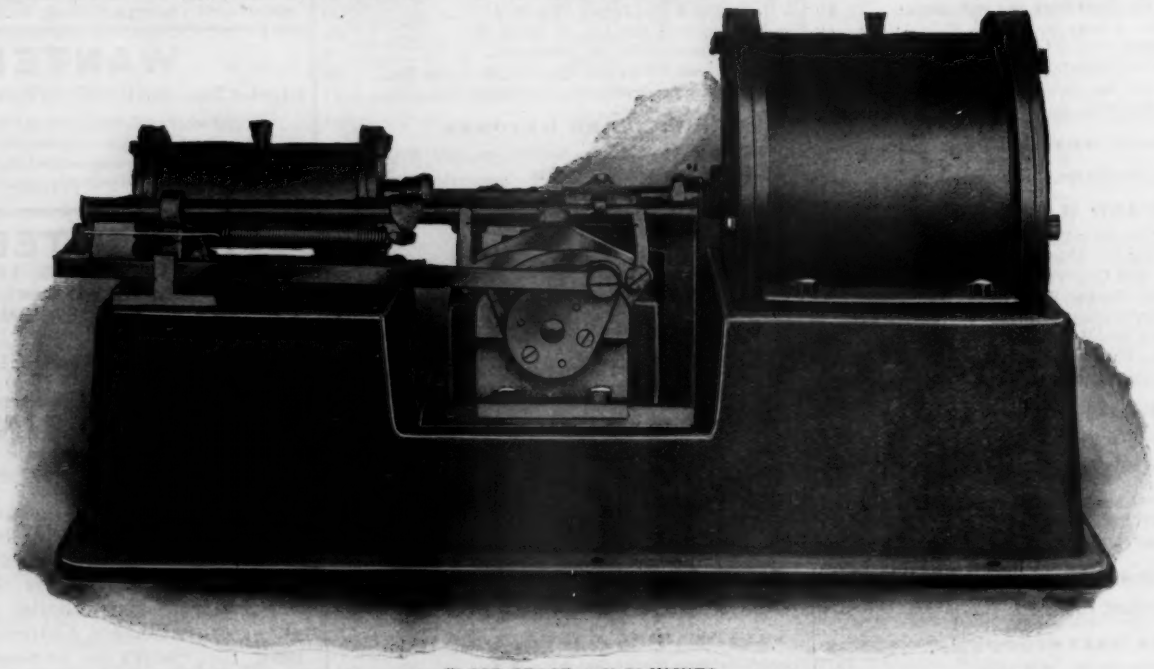

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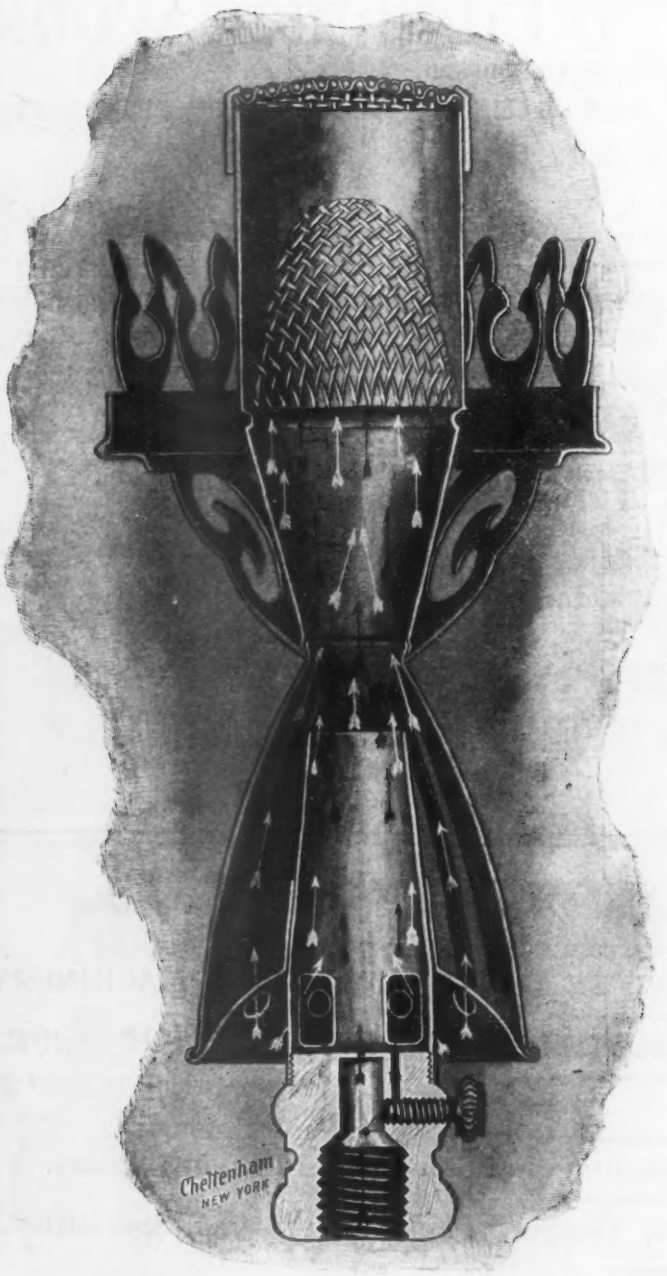

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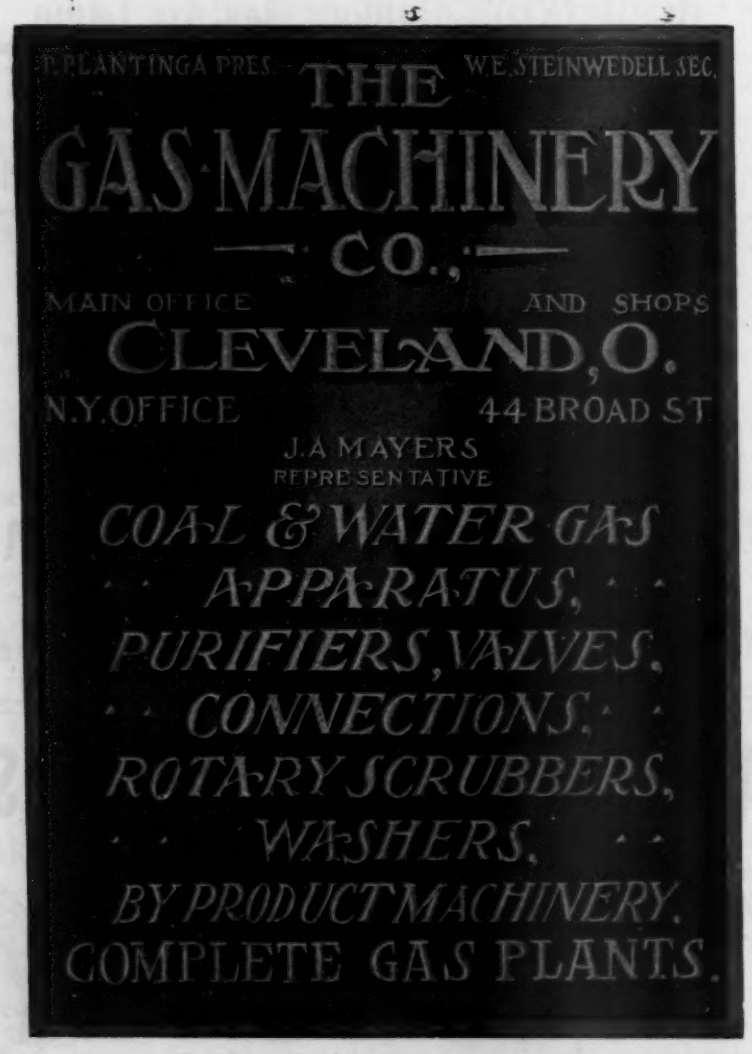

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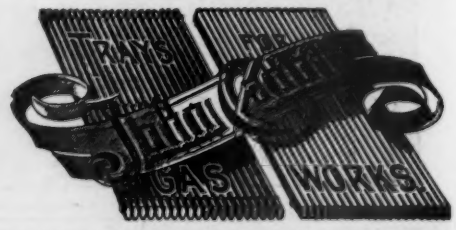

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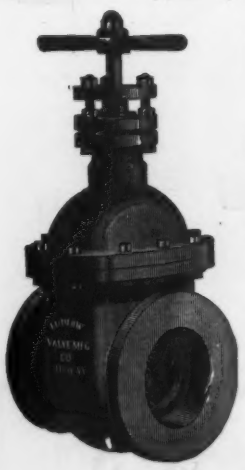

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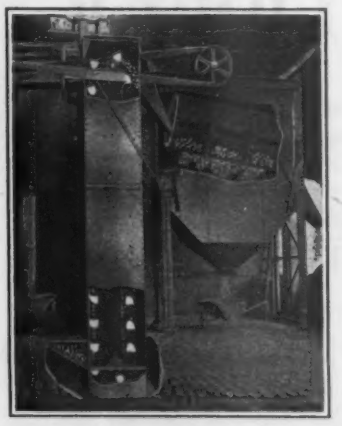

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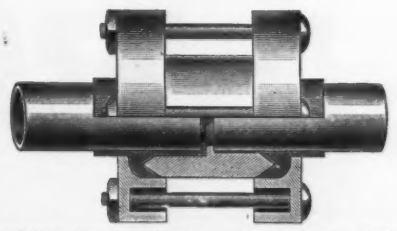

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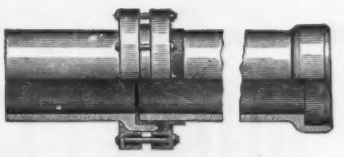

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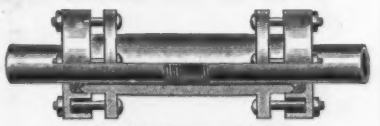

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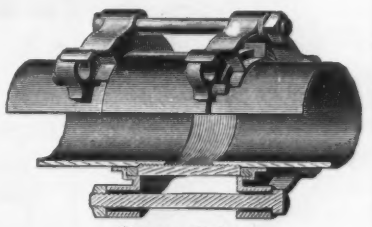

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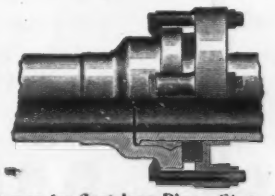

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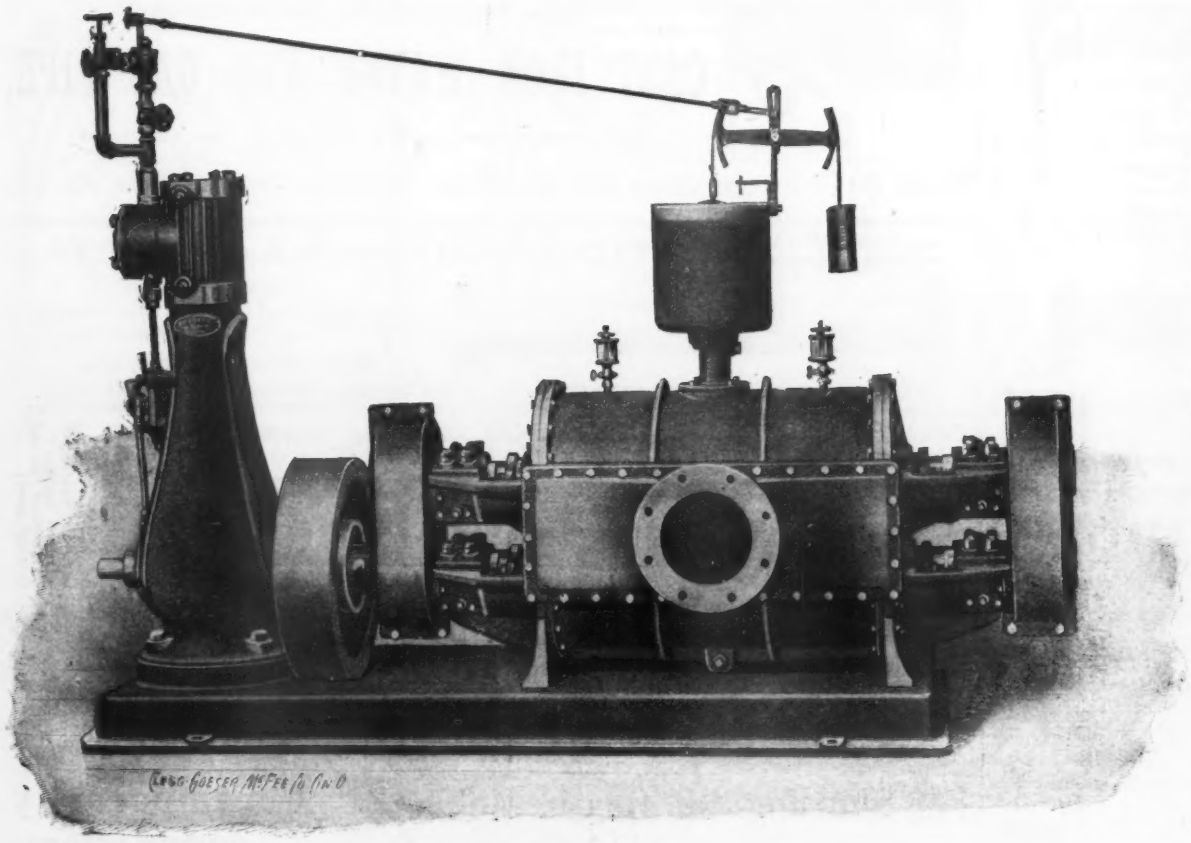

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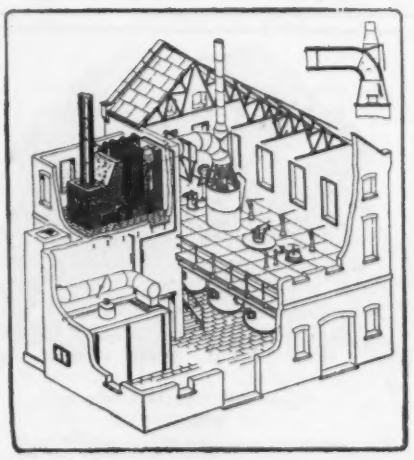

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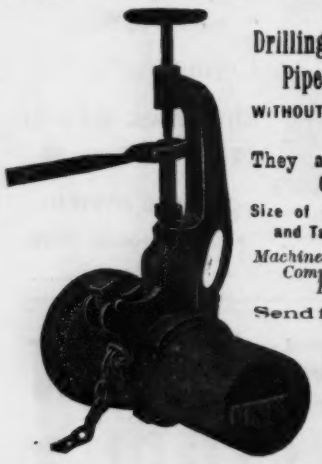

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THE ECONOMICAL
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Consulting Engineers.
Builders of UP-TO-DATE Machinery and Appliances for Coal and Water Gas Plants. :: :: :: :: ::
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Specially adaptable for—
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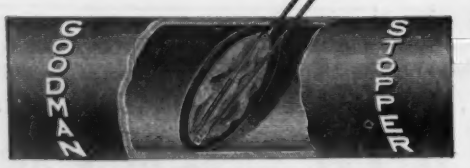
For Shutting Off Gas in Mains
Temporarily during alterations and repairs. : : : :
Any size gas main can be shut off in 30 seconds. : : :



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STATIONARY, SHAKING, DUMPING.
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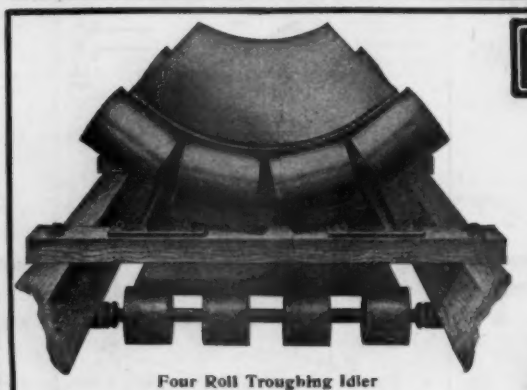

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FOR WIDE BELTS.
The positions of the rolls conform to a natural and uniform curve of the belt.

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EQUIPPED WITH
BALL BEARING ROLLS
Possess greater efficiency, consume less power, and the belts last much longer than when any other type of roll is employed.
Permit us to tell you why and to submit plans and estimates.
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ESTABLISHED 1836. INCORPORATED 1868.

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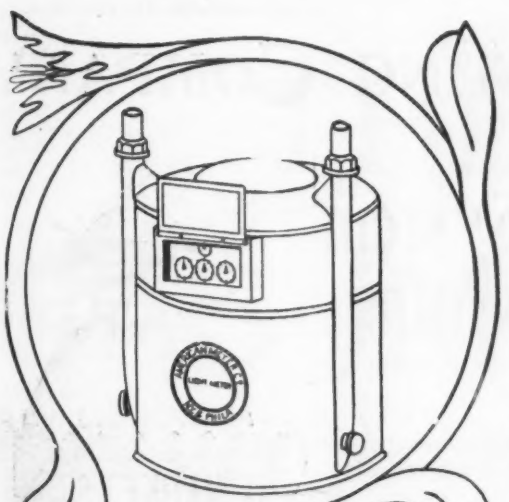
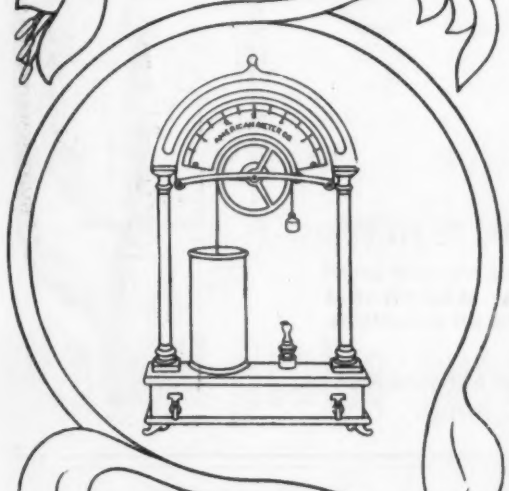
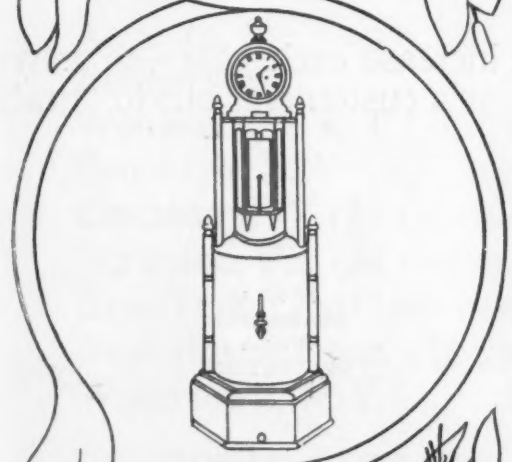
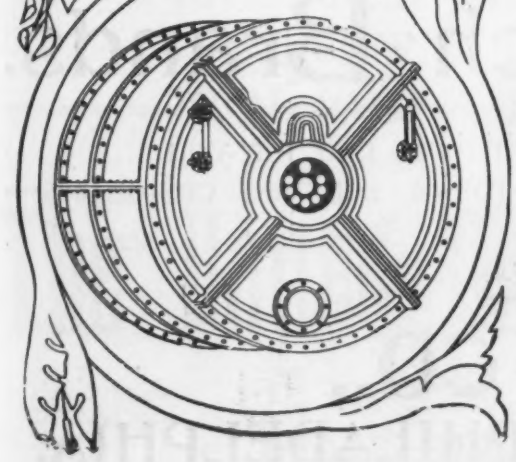
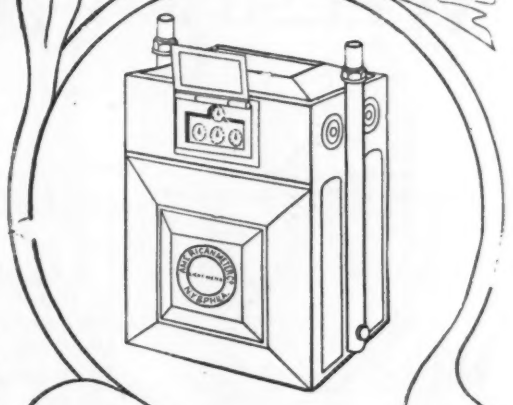
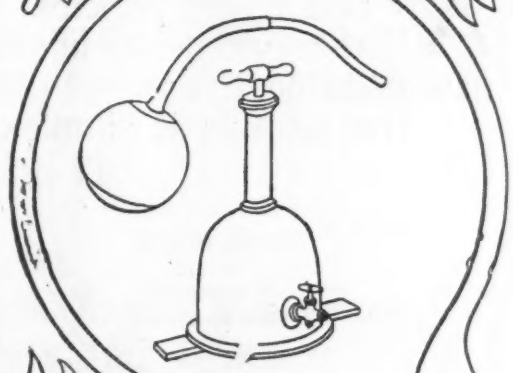


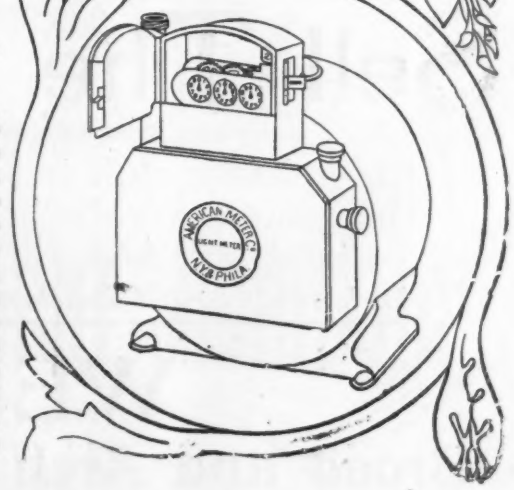












PUBLIC LIGHTING TABLE.

OCTOBER, 1904.

Day of Week.	Date.	Table No. 1. FOLLOWING THE MOON. Light.	Extinguish.	Table No. 2. NEW YORK CITY. ALL NIGHT LIGHTING. Light.	Extinguish.
				P.M.	A.M.
Sat.	1	6.20 PM	11.30 PM	5.30	5.00
Sun.	2	6.10 LQ	12.20 AM	5.30	5.00
Mon.	3	6.10	1.30	5.30	5.00
Tue.	4	6.10	2.30	5.30	5.00
Wed.	5	6.10	5.00	5.30	5.00
Thu.	6	6.10	5.00	5.30	5.00
Fri.	7	6.10	5.00	5.30	5.00
Sat.	8	6.10 NM	5.00	5.20	5.10
Sun.	9	6.00	5.10	5.20	5.10
Mon.	10	6.00	5.10	5.20	5.10
Tue.	11	6.00	5.10	5.20	5.10
Wed.	12	6.00	5.10	5.20	5.10
Thu.	13	8.00	5.10	5.20	5.10
Fri.	14	9.00	5.10	5.20	5.10
Sat.	15	9.50 FQ	5.10	5.10	5.20
Sun	16	10.50	5.10	5.10	5.20
Mon.	17	11.40	5.10	5.10	5.20
Tue.	18	12.40 AM	5.10	5.10	5.20
Wed.	19	1.30	5.10	5.10	5.20
Thu.	20	2.30	5.10	5.10	5.20
Fri.	21	3.20	5.10	5.10	5.20
Sat.	22	No L.	No L.	5.00	5.30
Sun.	23	No L. FM	No L.	5.00	5.30
Mon.	24	No L.	No L.	5.00	5.30
Tue.	25	5.40 PM	7.10 PM	5.00	5.30
Wed.	26	5.40	7.50	5.00	5.30
Thu.	27	5.40	8.30	5.00	5.30
Fri.	28	5.40	9.20	5.00	5.30
Sat.	29	5.40	10.20	4.45	5.35
Sun.	30	5.30	11.10	4.45	5.35
Mon.	31	5.30 LQ	12.20 AM	4.45	5.35

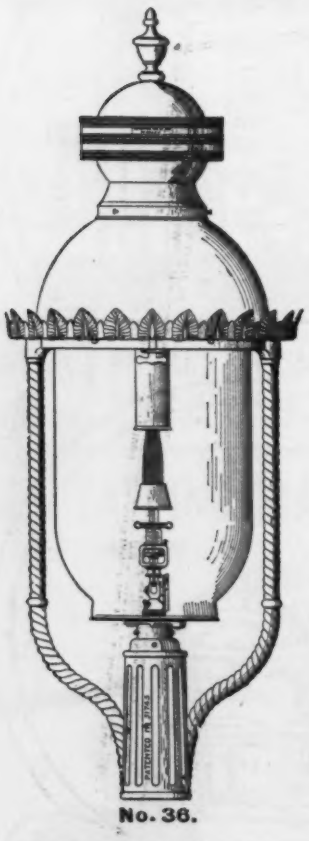
TOTAL HOURS LIGHTING DURING 1904.

By Table No. 1.	Hrs. Min.	By Table No. 2.	Hrs. Min.
January	225.00	January	423.20
February	205.40	February	367.40
March	187.40	March	355.35
April	169.50	April	298.50
May	152.30	May	264.50
June	137.20	June	234.25
July	138.50	July	243.45
August	151.00	August	280.25
September	164.40	September	321.15
October	191.30	October	374.30
November	210.30	November	401.40
December	237.10	December	433.45
Total, yr.	2171.40	Total, yr.	4000.00

NEW YORK, 97 Liberty Street. BOSTON, 814 Beacon Building. PHILADELPHIA, Broad and Arch Streets. ST. LOUIS, 712 Roe Building. CHICAGO, Foot of Orleans Street. SAN FRANCISCO, 712 Polk Street.

WELSBACH STREET LIGHTING COMPANY

.... OF AMERICA ....



No. 36.

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Which includes its specially DESIGNED AND PATENTED BURNER for STREET and PARK LIGHTING exclusively.

Uniformly SUCCESSFUL in 150 Cities and Towns.

By means of the Welsbach System of street lighting the superiority of GAS over electricity for street lighting has been fully demonstrated.

POINTS OF MERIT:

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IT LIGHTS THE STREET.

Where there are no gas mains we can furnish an equally good light by our SELF-GENERATING NAPHTHA WELSBACH BURNER, and thereby supply a uniform light in all localities.

Correspondence Solicited from Gas Companies and Others interested in Municipal and Outside Lighting.

No. 38.

AN underlying principle in business is to show an increase each year---to grow. The astute dealer not only seeks to retain this year's customers, but to attract new trade next year.

The formula is simple-

THIS SHIELD IS THE WELSBACH TRADE MARK.

IT IS A GUARANTEE AND A PROTECTION.

Sell The Welsbach Brands.

The imitation stuff is bad for the customer---which is bad for you.

The genuine Welsbachs---Burners or Mantles---make satisfied customers---keep customers---MAKE NEW ONES.

And your profit isn't merely dollars and cents.

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Broad and Arch Sts., PHILADELPHIA.

THE UNITED GAS IMPROVEMENT COMPANY

For the Period Ending July 31st, 1904, has been Awarded Contracts in the Following Places for

Standard Double-Superheater Lowe Water Gas Apparatus.

Augusta, Me.
Bangor, Pa.
Woonsocket, R. I. (2d contract).
Brooklyn, N. Y. (4th contract).
Cincinnati, O. (2d contract).
Scranton, Pa. (3d contract).
New York City (14th contract).
New Haven Conn. (2d contract).
Watertown, N. Y.
Tampa, Fla. (3d contract).
Westchester, N. Y. (3d contract).
Bridgeport, Conn. (2d contract).
St. Paul, Minn. (2d contract).
Harrisburg, Pa.
Pelham, N. Y.
Reading, Pa.
Springfield, Mass. (2d contract).
Lynn, Mass. (5th contract).

TOTAL SETS, 1904, ... 35
TOTAL DAILY CAPACITY, 1904, . . 50,400,000 cubic feet.
TOTAL SETS TO DATE, ... 543
TOTAL DAILY CAPACITY, . . . 413,180,000 cubic feet.

The United Gas Improvement Company,

Broad and Arch Streets, Philadelphia.

Established 1858. Incorporated 1890.
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FLEMMING GENERATOR GAS FURNACE

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With either Horizontal, Inclined or Vertical Retorts.

PATENTS APPLIED FOR.

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No. 3. Vertical retorts with vertical charge and discharge. Sixteen retorts in one bench.

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Fire Brick, Tiles, Etc.

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A Cement of great value for patching retorts, putting on mouthpieces, making up all bench-work joints, lining blast furnaces and cupolas. This cement is mixed ready for use. Economic and thorough in its work. Fully warranted to stick.

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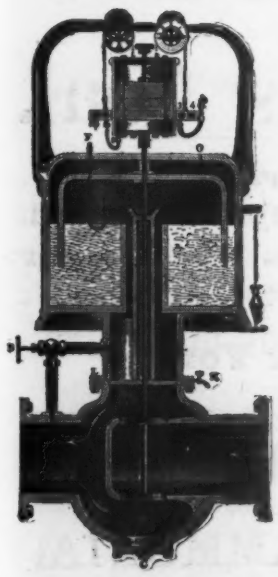

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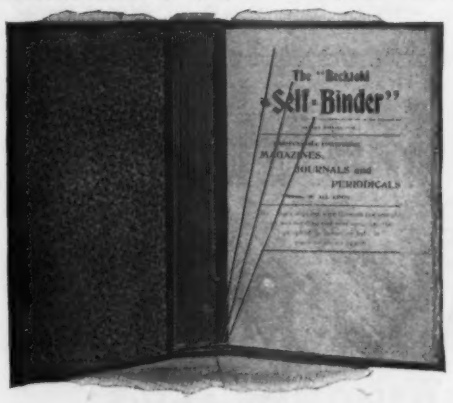

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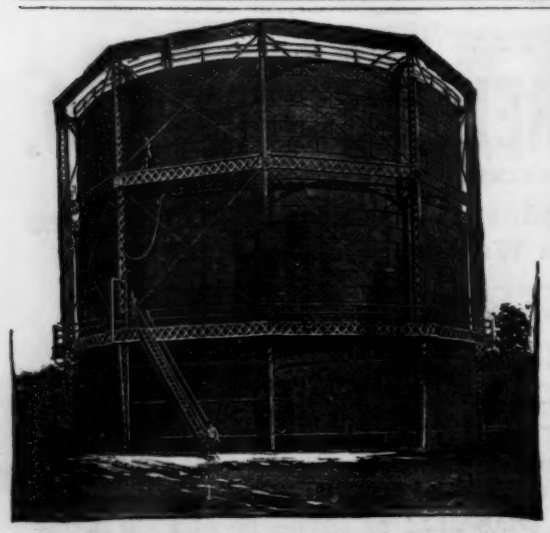

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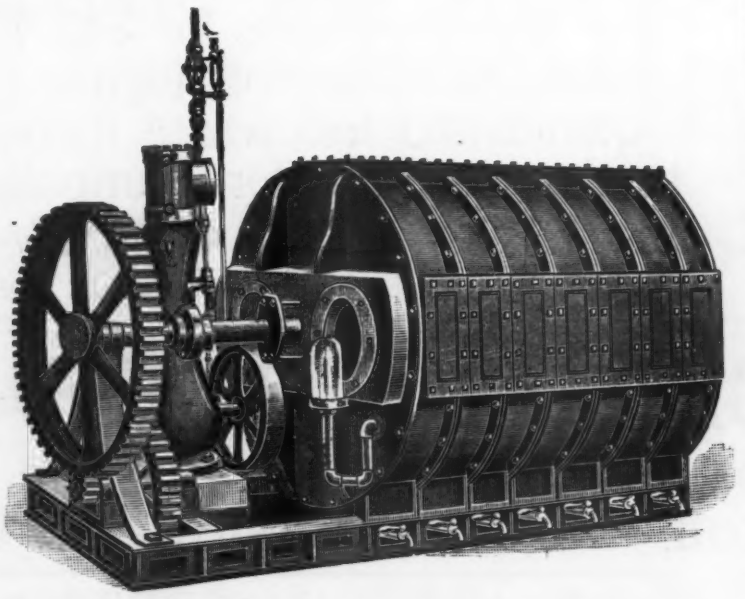

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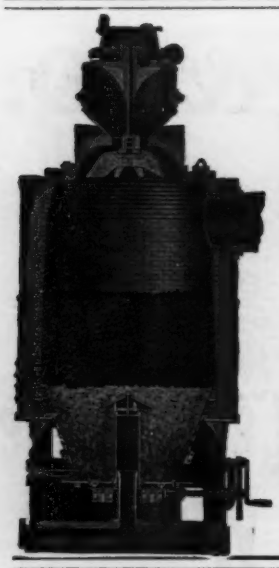

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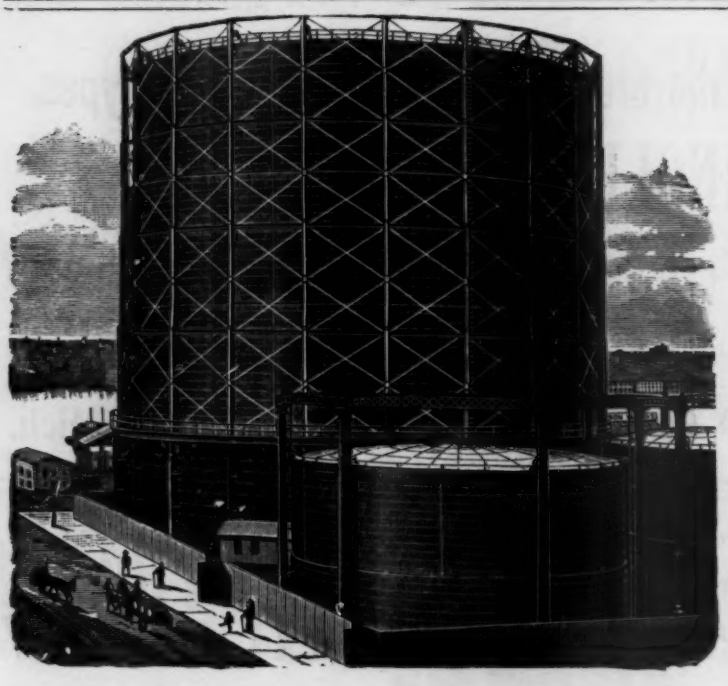

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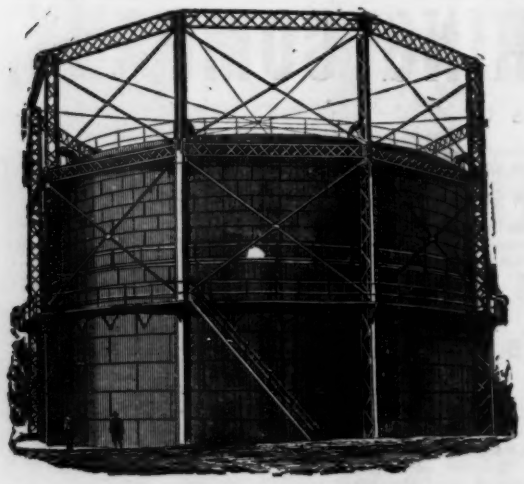

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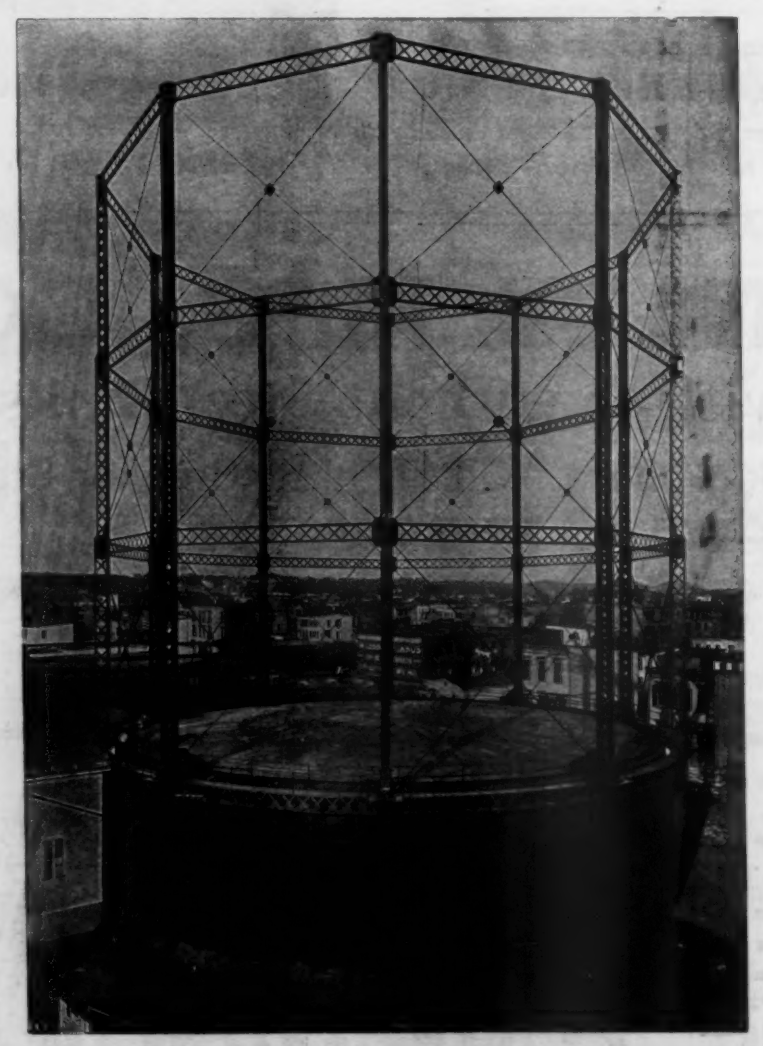

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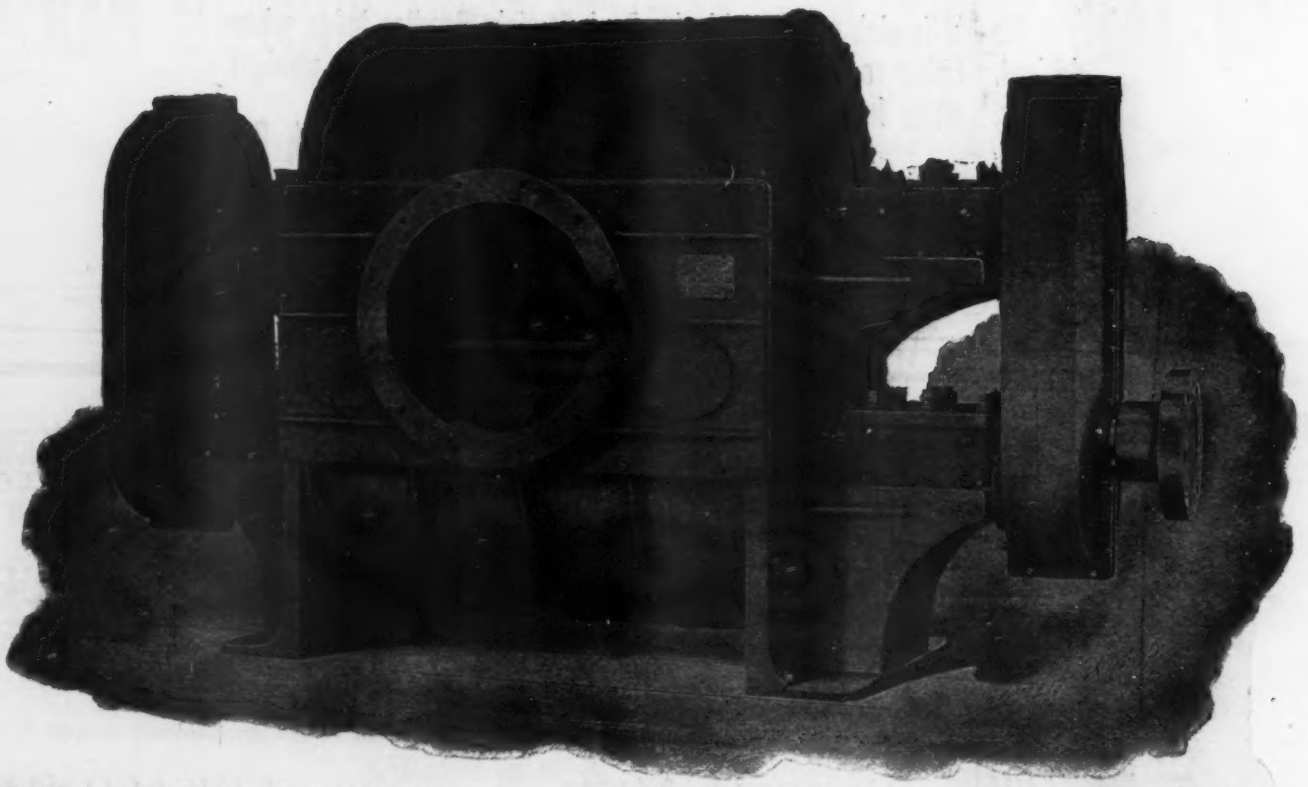

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